4.2 WATER QUALITY

This section presents the environmental setting and impacts analysis of water quality issues associated with the granting of a new lease for Chevron USA, Inc. to operate its Long Wharf in San Pablo Bay. Information is provided on existing water and sediment quality in the San Francisco Bay Estuary and, in more detail for the project area. The regulatory setting on a Federal, State, and local level is also presented. Impacts and mitigation measures are then presented for the proposed Project, alternatives and cumulative environment. Water quality issues associated with renewing Long Wharf lease include the chronic water quality impacts of continuing operations and those related to a crude oil or product spill. Operational impacts to water quality could come from the release of segregated ballast water, runoff of contaminants on the pier, the leaching of contaminants from antifouling paints or sacrificial anodes from ships visiting the Long Wharf, the resuspension of sediments by ship propellers and bow thrusters or by maintenance dredging, and the disposal of dredged sediments. A spill of crude oil or product could have wide ranging effects on water quality in San Francisco Bay.

4.2.1 Environmental Setting

San Francisco Bay/Estuary Regional Setting

Introduction

San Francisco Bay/Estuary is the largest estuary on the West Coast of the contiguous United States and covers an area of 1,166 square kilometers (450 square miles). The majority of San Francisco Bay is roughly parallel to the coastline in a north to south orientation (Figure 4.2-1), about 5 miles inland from the coastline. Several bridges span the Bay connecting the urban areas along the edges of the Bay. These bridges also serve as dividing lines for subregions of San Francisco Bay. South San Francisco Bay is the large area south of the Bay Bridge, while the Central Bay is a relatively smaller area between the Bay Bridge and Richmond-San Rafael Bridge. San Francisco Bay's connection to the Pacific Ocean is a small opening in the landmass at the Golden Gate Bridge. San Pablo Bay is a large area north of the Richmond-San Rafael Bridge. From San Pablo Bay, the San Francisco Bay/Estuary extends eastward through the Carquinez Strait, past Suisun Bay, to the Delta of the Sacramento and San Joaquin Rivers.

Water quality of San Francisco Bay and Estuary Bay is affected by many factors, including:

- geographic configuration of the Bay;
- tidal exchange with the ocean;
- freshwater inflows;
- industrial and municipal wastewater discharges;

Figure 4.2-1 – Depth Contours for San Francisco and San Pablo Bays

- dredging and dredge material disposal;
- runoff from highly urbanized areas adjacent to the Bay;
- agricultural and pasture land drainage from much of central California;
- marine vessel discharges;
- historic mining activities;
- leaks and spills; and
- atmospheric deposition.

Bathymetry

Depth contours for San Francisco Bay are shown on Figure 4.2-1. Water depths in San Francisco Bay range from zero to greater than 100 meters (m) at the entrance to the Bay at the Golden Gate Bridge. The deeper portions of the Bay are along the west side of Central Bay. The strong tidal currents in Central Bay result in significant sand waves along the bottom that have heights of 2 to 3 m.

Much of the Bay is relatively shallow. Approximately half the surface area of the Bay has water depths less than 2 m below MLLW when intertidal mudflats are included in the definition of the surface area (Conomos et al. 1985). The 10-m-depth contour extends about a third of the way into South San Francisco Bay. Dredging of a narrow channel has extended this contour through South San Francisco Bay. The 10-m-depth contour extends northward to Carquinez Strait in a fairly narrow shipping channel. Depth contours in San Francisco Bay/Estuary are very important because they direct the strong tidal flow in the Bay.

Tidal Exchange with the Ocean

Water quality of San Francisco Bay/Estuary is greatly affected by tidal exchange with the Pacific Ocean through the Golden Gate. The average tide range for the San Francisco Bay Area is about 5 feet of elevation change. With the large surface area of San Francisco Bay, this results in extremely large volumes (50×10^9 cubic feet, or 1 million acre feet) of water flowing into and out of the Bay every 6 hours with the change of tides. The bottom contours of the Bay direct the flow of the flooding tide into North and South San Francisco Bay. Large eddies are created in Central San Francisco Bay by the tidal exchange. Waters from the Pacific Ocean are generally saltier and cooler than the waters in San Francisco Bay, and thus the tidal exchange is generally in the deeper waters of the Bay.

Freshwater Inflow

San Francisco Bay/Estuary is where fresh water from rivers that drain much of central California meets seawater. The Sacramento and San Joaquin Rivers are the largest sources of fresh water, contributing on average 19.3 and 3.4 million acre feet per year (MAF), respectively. The confluence of these two rivers and several other smaller rivers forms the extensive river Delta area of the San Francisco Bay/Estuary. These rivers' watersheds cover 155,400 square kilometers (60,000 square miles) (40 percent of the State) and convey 47 percent of the State's runoff (San Francisco Estuary Institute 1997). The volume and timing of these freshwater inflows vary dramatically from year to year depending on the amount of rain and snowfall. From 1980 through 2003, freshwater inflows to the San Francisco Bay/Estuary ranged from 6 MAF in 1990 to 65 MAF in 1983. Drought conditions occurred in 1989 through 1992 and 1994 (Brown et al. 2004). The wet season of 1993 marked the end of a 7 year drought and annual mean inflows also increased in 1995-1999. Normal or above normal rainfall has meant improved Delta inflows in recent years. Inflows to the Delta and Estuary were 15.4 MAF in water-year 2002 and 21 MAF in water-year 2003 (San Francisco Estuary Project 2004). This fresh water is generally warmer than the ocean water, and with its low salinity, is less dense than seawater. The surface waters of San Francisco Bay are strongly influenced by this freshwater inflow.

Circulation and Dispersion Capacity

Circulation and mixing are relatively complicated in San Francisco Bay because of the complex geometry and variable amount of freshwater flow during the year. Maintaining a sufficient Delta flow of fresh water is important for dispersing and flushing wastes from the Bay. The circulation of water in the Bay is driven primarily by tides, and to some extent, by wind-induced currents and estuarine circulation.

Tides are responsible for most of the water motion in the Bay. They are the dominant force for mixing and contribute greatly to the dispersion of material. Nevertheless, tidal motion is oscillatory and consequently contributes proportionally little to the net transport of material out of the Bay (Davis 1982). Net transport out of the Bay is equivalent to freshwater flows into the Bay (including publicly owned treatment works [POTW] and industrial discharges) and the amount of new ocean water introduced by tides. Freshwater flows into the Bay from the Delta result in estuarine circulation that is driven by the density difference between fresh and saline ocean water. These flows vary greatly with location in the Bay and the amount of freshwater input. Vertical stratification of water quality parameters in the Bay varies greatly with the location and the amount of the freshwater flows.

During the winter, the water residence time is approximately 2 weeks for the northern reaches of the Bay, while in southern portions of the Bay, residence times are approximately 2 months. During the summer, water residence time is 2 months for the northern reaches of the Bay, while in the southern portions of the Bay, residence times are 5 months (Conomos 1979).

Wind mixing, like tidal mixing, contributes greatly to local mixing, but contributes very little to net flow of fluids, sediments, and pollutants out of the Bay.

Industrial and Municipal Wastewater Discharges

San Francisco Bay/Estuary receives inputs from industrial and municipal discharges. Table 4.2-1 shows the permitted dischargers in the Bay. Many of the industrial discharges are in San Pablo Bay and the upper reaches of the Bay. There are six refineries in this area and several chemical companies. Chevron's Refinery has a flow of 6 to 8 million gallons per day (mgd). Chevron's permitted discharge consists of biologically treated process water followed by granular activated carbon (GAC) filtration. The source of this process water is from plant operations, cooling water tower blowdown, groundwater extraction, miscellaneous sources, and potentially stormwater during the wet season. Figure 4.2-2 shows the location of major point source dischargers in San Francisco Bay. The Bay receives treated wastewater from several municipal discharges that serve the large metropolitan areas surrounding the Bay. Municipal discharges are the largest point source discharges to San Francisco Bay. Permitted dry weather flow is 565 mgd for municipal discharges to San Francisco Bay (RWQCB 1995). The average dry weather flow is less than this maximum permitted amount. Effluent discharges are considered to currently be a significant pathway for two high priority contaminants, selenium and organophosphate pesticides (Davis et al. 2000).

Table 4.2-1
List of Major Effluent Discharges to San Francisco Bay and Their Average Daily Discharge Volumes for 1998

Facility	Flow (MGD)	Treatment
San Jose/Santa Clara WPCP	133	Advanced
East Bay MUD	92	Secondary
City & Co. of San Francisco Southeast	87	Secondary
Union Sanitary District – Alvarado	31	Secondary
Central Contra Costa S.D.	52	Secondary
City of Palo Alto	29	Advanced
City of Sunnyvale	18	Advanced
South Bayside System Authority	21	Secondary
Fairfield Suisun Sew District	17	Secondary
Vallejo Sanitation & Flood Cont.	14	Secondary
LAVWNMA, Livermore-Amador Valley WMA	NA	Secondary
South San Francisco/San Bruno WQCP	11	Secondary
C&H Sugar	1	Activated sludge
Tosco Corp. at Avon	5	Pond/RBC/carbon
Tosco Corp. at Rodeo	3	Pond/RBC/carbon
Shell Oil Company	6	Activated sludge/carbon
EXXON	3	Activated sludge/carbon
Chevron USA	8	Activated sludge/wetland
Source: Davis et al. 2000.		

Figure 4.2-2 – Location of Major Industrial Municipal Discharges in San Francisco Bay

Marine Vessel Discharges

Marine vessels are also sources of various pollutants to the estuary. The discharge of untreated sewage and gray water from commercial and recreational vessels has caused concern in various parts of the estuary. Vessel discharges, including release of bilge waters, are prohibited within the Bay. However, an unknown amount of wastes is believed to be illegally discharged directly into estuarine waters. This type of effluent contributes coliform bacteria, biochemical oxygen-demanding substances, nutrients, oil and grease, and suspended solids. In addition, the discharge of ballast water from large commercial vessels has introduced exotic species of aquatic organisms into the estuary. The introduction of exotic species via ship's ballast water has severely disturbed the aquatic communities of San Francisco Bay. The problems of exotic species introductions are discussed in detail in Section 4.3, Biological Resources. Accidental spills of petroleum products from ships are generally small and result from operator errors, handling accidents at terminals, and damage to ships but add to chronic pollution. Tanker accidents have resulted in major oil spills in San Francisco Bay.

Dredging

Every year, an average of 6 million cubic yards (mcy) of sediments must be dredged from shipping channels and related navigation facilities throughout San Francisco Bay. In the past, the majority (80 percent) of dredged material was disposed at designated sites in the Bay. Today there are three in-Bay disposal sites designated for multiple users: the Carquinez Strait, San Pablo Bay, and Alcatraz Island disposal sites. The Alcatraz site is the most heavily used of the in-Bay sites, receiving up to 4 mcy of sediment per year from Central and South Bay dredging projects. Another 1 to 2 mcy of dredged material per year is disposed at the Carquinez Strait site, and up to 0.5 mcy at the San Pablo Bay site. Two additional aquatic disposal sites, the Suisun Bay site and the San Francisco Bar Channel site just outside the Golden Gate, are restricted to disposal of clean sand from Corps maintenance dredging projects. The LTMS for Placement of Dredged Material in the San Francisco Bay Region calls for a balanced upland/wetland reuse and ocean disposal (Corps et al. 1998). This preferred alternative includes low in-Bay disposal (approximately 20 percent compared to the present 80 percent), medium ocean disposal (approximately 40 percent), and medium upland/wetland reuse (approximately 40 percent). The transition from in-Bay disposal to beneficial use of dredged material will be achieved gradually over a 12-year transition period (USACE, USEPA, BCDC, and SWBRWQCB 2001). The 12-year transition begins with an overall in-Bay disposal volume of 2.8 mcy plus a contingency volume (for unforeseen events) of up to 250,000 cubic yards. During this period, the volume of material allowed for in-Bay disposal will decrease by 387,500 cubic yards every 3 years. Dredged material disposal is considered to be a minor pathway for the loading of contaminants to San Francisco Bay (Davis et al. 2000). Copper is the only contaminant where this pathway may be significant.

Urban Runoff

Urban runoff is the water from urban areas that flows into the Estuary in streams and storm drains. It includes rainwater, excess irrigation flows, and water used for washing down sidewalks and parking lots.

Sources of pollutants in urban runoff are extremely varied and include commercial, industrial, and residential land uses, as well as pollutants from managed open space areas such as parks, cemeteries, planted road dividers, and construction sites. Human activities in these areas, such as the application of pesticides and fertilizers to gardens and landscaping, operation of motor vehicles, and construction of roads and buildings, all contribute pollutants to urban runoff.

A recent study of contaminant loads from stormwater to the San Francisco Bay region indicated that residential areas appeared to be a large contributor to all of the metals (Davis et al. 2000). Commercial and industrial areas generate substantial loads of phosphate, cadmium, lead, zinc, and other contaminants.

Nonurban Runoff

Nonurban runoff refers to runoff from agricultural lands, forests, pasture, and natural range. It includes rainfall runoff, excess irrigation return flows, and subsurface agricultural drainage. Pollutants of concern in nonurban runoff include trace elements, synthetic organic pollutants (particularly pesticides), and solvents used for pesticide application.

Atmospheric Deposition

Contaminants in the atmosphere deposit on both land and water surfaces. Deposition to the land results in transfer to the Bay in stormwater runoff. Available information suggests that direct atmospheric deposition may be a significant pathway for loading of dioxins, PAHs, PCBs, and mercury (Davis et al. 2000).

Project Area (San Pablo Bay)

The Long Wharf is located in Central San Francisco Bay on the east side of the Bay, just south of the Richmond-San Rafael Bridge. The area examined herein surrounds the Long Wharf and extends from the Bay Bridge in the south to the Carquinez Straits in the north, and westward to the Golden Gate Bridge. Particular emphasis is placed on information on water and sediment quality in the vicinity of the Long Wharf.

Circulation

Water circulation in the project area is greatly affected by and related to tides. Tides in the area are of a mixed semi-diurnal type with two highs and lows of unequal portions each 24-hour period and 50-minute tide cycle. Tides at the Long Wharf have a mean high water of 5.3 feet, mean sea level of 3.2 feet, and a mean lower low tide of 0.0 feet.

Flood tidal currents occur between a low tide and a subsequent high tide. The maximum tidal current occurs approximately 1.5 hours after the peak rate of change in tide height. Magnitude of the flooding tide is proportional to the rate of change in tide height. For example, a 1.8-knot (93 centimeters per second [cm/sec]) peak flood current occurs when the tide increases from -0.9 to 5.5 feet in 7 hours. At Red Rock, approximately 2 km (1.3 miles) from the Long Wharf, peak flooding tidal currents flow toward 317 degrees true, while peak ebbing tides flow toward 174 degrees true. Ebb tidal currents at Red Rock can exceed 2.2 knots (113 cm/sec) when tide height decreases from 6.67 feet to -0.91 feet in 6.5 hours. These two examples are relatively large changes in tide, and slower tidal currents occur with smaller changes in tide height.

Water Column Characteristics

The amount of Delta runoff greatly affects water column characteristics in the project area and results in a great variance in water quality conditions from year to year. The amount of Delta outflow determines water mass characteristics for much of the project area. During periods of high Delta outflow, the waters in the project area are estuarian with low salinity (5 to 10 ppt). During low Delta outflows (summer/fall and dry years), the waters in the project area are more oceanic (with salinity of 25 to 33 ppt).

During periods of high Delta outflow, the dissolved oxygen concentrations of surface waters were between 80 and 90 percent saturation (Cloern 1997). This is due to the higher loads of suspended solids when the Delta has high outflow. During 1994, when Delta outflow was low, dissolved oxygen throughout the Bay was generally 100 to 110 percent saturation.

Water Quality

The San Francisco Bay Basin Plan designates beneficial uses for waterbodies covered by the plan (RWQCB 1995). Designated beneficial uses for waters in the project area (San Francisco Bay Central) include ocean commercial and sport fishing, estuarine habitat, industrial service supply, fish migration, navigation, industrial process supply, preservation of rare and endangered species, water contact recreation, noncontact water recreation, shellfish harvesting, fish spawning, and wildlife habitat.

The project area, including both Central Bay and San Pablo Bay is on the California 303(d) list of impaired waterbodies for a variety of pollutants (Table 4.2-2). Central Bay is on the 303(d) list for chlordane, DDT, diazinon, dieldrin, dioxins, exotic species, furan compounds, mercury, PCBs, and selenium (SWRCB 2003). San Pablo Bay is on the 303(d) list for all of the pollutants listed for Central Bay and for nickel.

Table 4.2-2
Waterbodies of the San Francisco Bay Area on California 303(d) List of Impaired Waterbodies and TMDL Priority Schedule

Waterbody	Pollutants/Stressors	Priority	Source
San Francisco Bay, Central	Chlordane (this listing was made by USEPA)	Low	Nonpoint Source
	DDT (this listing was made by USEPA)	Low	Nonpoint Source
	Diazinon (diazinon levels cause water column toxicity. Two patterns: pulses through riverine systems linked to agricultural application in late winter and pulse from residential land use areas linked to homeowner pesticide use in late spring, early summer. Chlorpyritos may also be the cause of toxicity; more data needed, however.)	Low	Nonpoint Source
	Dieldrin (this listing was made by USEPA.)	Low	Nonpoint Source
	Dioxin Compounds (this listing was made by USEPA.)	Low	Atmospheric Deposition
	Exotic Species (disrupt natural benthos; change pollutant availability in food chain; endanger food availability to native species.	Medium	Ballast Water
	Furan Compounds (this listing was made by USEPA.)	Low	Atmospheric Deposition
	Mercury (current data indicate fish consumption and wildlife consumption impacted uses; health consumption advisory in effect for multiple fish species including striped bass and shark. Major source is historic; gold mining sediments and local mercury mining; most significant ongoing source is erosion and drainage from abandoned mines; moderate to low level inputs from point sources.)	High	Industrial Point Sources Municipal Point Sources Resource Extraction Atmospheric Deposition Natural Sources Nonpoint Source
	PCBs (non dioxin-like) (interim health advisory for fish; uncertainty regarding water column concentration data.)	High	Unknown Nonpoint Source
	PCBs (dioxin-like) (this listing was made by USEPA)	Low	Unknown Nonpoint Source
	Selenium (affected use is one branch of the food chain; most sensitive indicator is hatchability in nesting diving birds, significant contributions from oil refineries (control program in place) and agriculture (carried downstream by rivers); exotic species may have food chain more susceptible to accumulation of selenium; health consumption advisory in effect for scaup and scoter (diving ducks); low TMDL priority because Individual Control Strategy in place.)	Low	Industrial Point Sources Agriculture Natural Sources Exotic Species

Table 4.2-2 (Continued)
Waterbodies of the San Francisco Bay Area on California 303(d)
List of Impaired Waterbodies and TMDL Priority Schedule

Waterbody	Pollutants/Stressors	Priority	Source
San Pablo Bay	Chlordane (this listing was made by USEPA)	Low	Nonpoint Source
	DDT (this listing was made by USEPA.)	Low	Nonpoint Source
	Diazinon (Diazinon levels cause water column toxicity. Two patterns: pulses through riverine systems linked to agriculture application in late winter and pulse from residential land use areas linked to homeowner pesticide use inlate spring, and early summer. Chlorpyritos may also be the cause of toxicity; more data needed however.)	Low	Nonpoint Source
	Dieldrin (this listing was m de by USEP.)	Low	Nonpoint Source
	Dioxin Compounds (this listing was made by USEPA.)	Low	Atmospheric Deposition
	Exotic Species (disrupt natural benthos; change pollutant availability in food chain; disrupt food availability to native species.)	Medium	Ballast Water
	Furan Compounds (this listing was made by USEPA.)	Low	Atmospheric Deposition
	Mercury (current data indicate fish consumption and wildlife consumption impacted uses; health consumption advisory in effect for multiple fish species including striped bass and shark. Major source is historic; gold mining sediments and local mercury mining; most significant ongoing source is erosion and drainage from abandoned mines; moderate to low level inputs from point sources	High	Municipal Point Source ResourceExtration AtmosphericDeposition Natural Sources Nonpoint Source
	Nickel (This listing was made by USEPA	Low	Unknown Source
	PCBs (non dioxin-like) (interim health advisory for fish; uncertainly regarding water column concentration data.)	High	Unknown Nonpoint Source
	PCBs (dioxin-like) (this listing was made by USEPA).	Low	Unknown Nonpoint Source
	Selenium (affected use is one branch of the food chain; most sensitive indicator is hatchability in nesting birds, significant contributions from oil refineries (control program in place) and agriculture (carried downstream by rivers); exotic species may have made food chain more susceptible to accumulation of selenium; health consumption advisory in effect for scaup and scoter (diving ducks); low TMDL priority because individual Control Strategy in place.)	Low	Industrial Point Sources Agriculture Natural Sources Exotic Species
Source: SWRCB 2003			

Since 1993, the San Francisco Estuary Institute has conducted a Regional Monitoring Program (RMP) for monitoring trace substances in water, sediment, and bivalves (San Francisco Estuary Institute 1998, 2000, 2001, 2005). A total of 24 stations for RMP water and sediment sampling are located between the rivers in the northeast Bay and the sloughs in the South Bay. Stations have been grouped into major regions including: Southern Sloughs, South Bay, Central Bay, Northern Estuary, Estuary Interface, and Rivers. The Rivers Region has stations at the Sacramento and San Joaquin Rivers. Chevron's Long Wharf is located in Central Bay between Station BC41 at Point Isabel and Station BC60 at Red Rock. Central Bay includes the waters between the Golden Gate, Bay, and Richmond-San Rafael Bridges. In 2002 the RMP switched from the 24 designated stations to a stratified random sampling scheme (San Francisco Estuary Institute 2005). Water and sediment samples are randomly allocated into five hydrogeographic regions of the estuary. These regions are Suisun Bay, San Pablo Bay, Central Bay, South Bay, and Lower South Bay. Surface water samples are collected at a depth of 1 meter at each station and are subsequently analyzed for dissolved organic carbon, suspended solids, dissolved and total heavy metal concentrations, PAH, PCB, DDT, pesticides, and HCH. In general, the RMP has found that the Central Bay region has the lowest amounts of dissolved metals in water.

In 2002 and 2003 concentrations of most metals and organic contaminants in the water column were highest in the southern regions of San Francisco Estuary (San Francisco Estuary Institute 2005). Much of the South Bay and Lower South Bay lie adjacent to watersheds with regions of urbanization, agriculture, and historic mercury mining. The southern reach also receives treated wastewater effluent from three municipal treatment facilities. Dissolved silver was highest at a station in the Central Bay. In 2003, maximum total concentrations of copper, mercury, nickel, lead and zinc were measured in San Pablo Bay and were associated with high suspended sediment concentrations. Concentrations of dissolved and total PAHs were highest in the San Pablo and Central Bay regions in 2003.

With the exception of copper in the South Bay, all regions of the Bay were below California Toxic Rule thresholds for dissolved metals and PAHs in 2003 (San Francisco estuary Institute 2005). On the other hand, in 2003 all regions of the Bay were above the California Toxics Rule threshold for protection of human health for total PCBs.

No data on concentrations of chemicals in the water column are available for the immediate vicinity of the Long Wharf. RMP station BC60 at Red Rock approximately 2 kilometers (1.3 miles) from the Long Wharf is the closest available site with water column data. Table 4.2-3 shows the range of contaminant concentrations recorded at this station each year between 1996 and 2001. After 2001, the RMP stopped sampling set stations and switched to a stratified random sampling scheme. All contaminant concentrations measured in the water at Red Rock through 2001 were well below criteria in the California Toxics Rule.

Sediments

The RMP sampled sediments at 47 stations throughout San Francisco Bay in 2003 (San Francisco Estuary Institute 2005). Stations were selected according to a stratified random sampling design.

Table 4.2-3
Ranges of Contaminant Concentrations (µg/L) in Four Seasonal Sets of Water Samples Taken at Red Rock (BC 60) Near the Long Wharf for 1997-2001
(All Data Shown in Dissolved Concentrations)

Trace Elements	1997	1998	1999	2000*	2001*
Ag	0.001	0.002 - 0.004	0.0035 - 0.0042	NA	0.0024 - 0.0031
As	1.22 - 2.02	1.37 - 1.66	1.30 - 1.72	1.51 – 1.63	1.54 - 1.85
Cd	0.02 - 0.08	0.01 - 0.05	NA	NA	0.048 - 0.072
Cr	0.11 - 0.27	0.18 - 0.38	NA	NA	NA
Cu	1.1 - 1.5	1.2 - 1.6	0.7 - 0.8	NA	0.58 - 0.88
Ni	1.3 - 1.6	1.2 - 2.1	0.9 - 1.0	NA	0.72 - 0.96
Pb	0.008 - 0.036	0.004 - 0.034	0.008 - 0.012	NA	0.010 - 0.012
Zn	0.3 - 0.7	0.1 - 1.1	0.5 - 0.7	NA	0.50 - 0.65
Hg	0.0002 - 0.0012	0.0008 - 0.0012	0.0006	0.00016 - 0.00037	0.0005
Se	0.08 - 0.17	0.08 - 0.17	0.08 - 0.11	ND - 0.159	ND - 0.09
Organic Contaminants					
Sum of PAHs	0.00439 - 0.007909	0.0038	0.0025 - 0.0089	0.0024	0.0032
Sum of PCBs	0.000076 - 0.000117	0.00004 - 0.00012	0.00005 - 0.000107	0.000078	0.000108
Chlorpyrifos	0.000072 - 0.0002	0.000074 - 0.00031	0.0000031 - 0.000071	0.000032	0.0000057
Diazinon	0.00049 - 0.0053	0.00039 - 0.004	0.0019 - 0.0044	0.00026	ND
p,p'-DDD	0.000004 - 0.000160	0.000057	0.000027 - 0.000037	0.000084	0.000031
p,p'-DDE	0.000031 - 0.000091	0.000024 - 0.00006	0.000012 - 0.000035	0.000012	0.000011
p,p'-DDT	0.000017	0.0000048	0.0000012 - 0.000004	ND	NA
Sum of Chlordanes	0.000059 - 0.000113	0.000037 - 0.000055	0.000039 - 0.000044	0.000068	0.000019

*** = Two sampling events for trace elements (winter and summer); one sampling set for organic contaminants (summer).**
NA = Data were Not Available.
ND = Not Detected.
Source: SFEI 2000, 2002.

In 2003 the highest sediment contaminant concentrations were measured at stations in San Pablo Bay, Central Bay, and lower South Bay. The highest concentrations of arsenic, mercury, and nickel were measured in San Pablo Bay, while the highest concentrations of cadmium, methylmercury and PAHs were documented at sampling locations in Central Bay. Central Bay sediments were significantly higher in PAHs than all other regions. Table 4.2-4 shows the number of contaminants that exceeded various sediment quality guidelines in 2003 as well as the results of toxicity tests with amphipods and bivalves. The highest number of ER-L exceedances was observed in the Central Bay. However, most of the sediments at stations in the project area (Central Bay and San Pablo Bay) were not toxic to amphipods and bivalves.

Site-specific data on contaminant levels at the Long Wharf are available from sediment sampling done by Chevron to support permit applications for maintenance dredging at the Long Wharf. Table 4.2-5 shows the concentration of contaminants in sediment near the Long Wharf for sets of samples taken between 1991 and 2001. Arsenic, chromium, copper, and mercury exceeded the ER-L level in some of the samples, but the concentrations of these metals in sediments at the Long Wharf generally were below the Ambient Sediment Concentration thresholds for San Francisco Bay (arsenic at the Long Wharf exceeded the threshold in 1991 only, and chromium exceeded the threshold in 1998). Acenaphthene in Long Wharf sediments exceeded the ER-L in some samples in some years, and also was above the San Francisco Bay Ambient Sediment Concentration threshold in some samples. Fluorene and fluoranthene exceeded the ER-L and Ambient Sediment Concentration threshold in one sample in 1993. Fluorene also exceeded the ER-L in one sample in 2001. DDT exceeded the ER-L in Long Wharf sediment in 1998 and 2001 and one sample exceeded the Ambient Sediment Concentration threshold in 2001. PCBs at the Long Wharf exceeded the ER-L and the Ambient Sediment Concentration threshold in some samples in 2001. Nickel in Long Wharf sediments exceeded the ER-M in most years, but nickel concentrations at the Long Wharf generally were below the Ambient Sediment Concentration threshold for San Francisco Bay. Nickel appears to be naturally high within the San Francisco Bay watershed (San Francisco Estuary Institute 2002). Toxicity tests indicated relatively low toxicity for Long Wharf sediments. In summary these data indicate that sediments in the vicinity of the Long Wharf contain concentrations of contaminants that may have some adverse effects on benthic organisms, but that sediment concentrations were generally typical of the less contaminated portions of San Francisco Bay.

Table 4.2-6 shows the most recent (2005) data on contaminants in sediments at the Long Wharf. A PAH compound, acenaphthene, exceeded the ER-L and the Ambient Sediment Concentration thresholds in two samples. A second PAH compound, fluorine, exceeded the ER-L in the same two samples and Ambient Sediment Concentration threshold in one of those samples. In addition, one sample had a very high concentration of tributyltin.

Table 4.2-4
Summary of Sediment Quality for the RMP In 2003

Station Code	Site Name	Date	% Fines	No. of ASC Above Guidelines	No. of ERL Above Guidelines	No. of ERM Above Guidelines	Toxic to Amphipods	Toxic to Bivalves
BG20	Sacramento River	8/18/03	15	0*	1	1	No	Yes
BG30	San Joaquin River	8/18/03	73	0	3	1	No	Yes
BF21	Grizzly Bay	8/18/03	99	0	4	1	Yes	Yes
SU001S	Suisun Bay	8/19/03	22	1*	1	1	No	No
SU002S	Suisun Bay	8/18/03	18	1*	1	1	.	.
SU009S	Suisun Bay	8/18/03	95	0	3	1	No	Yes
SU010S	Suisun Bay	8/18/03	9	0*	NA	NA	.	.
SU011S	Suisun Bay	8/19/03	100	1	3	1	No	Yes
SU012S	Suisun Bay	8/18/03	93	0	4	1	.	.
SU013S	Suisun Bay	8/19/03	53	0	2	1	No	Yes
SU014S	Suisun Bay	8/18/03	57	0	2	1	.	.
BD31	Pinole Point	8/20/03	91	0	3	1	No	No
SPB001S	San Pablo Bay	8/19/03	98	0	4	1	Yes	No
SPB002S	San Pablo Bay	8/20/03	95	0	3	1	.	.
SPB009S	San Pablo Bay	8/20/03	96	0	3	1	No	No
SPB010S	San Pablo Bay	8/20/03	84	0	4	1	.	.
SPB011S	San Pablo Bay	8/19/03	98	0	3	1	No	No
SPB012S	San Pablo Bay	8/19/03	100	0	4	1	.	.
SPB013S	San Pablo Bay	8/19/03	97	0	4	1	No	No
SPB073S	San Pablo Bay	8/20/03	97	0	4	1	.	.
BC11	Yerba Buena Island	8/20/03	70	1	3	1	No	Yes
CB001S	Central Bay	8/21/03	71	1	5	1	No	No
CB002S	Central Bay	8/22/03	97	5	4	1	.	.
CB010S	Central Bay	8/21/03	86	2	3	1	.	.
CB011S	Central Bay	8/20/03	99	0	3	1	No	No
CB012S	Central Bay	8/21/03	58	25	16	1	.	.
CB013S	Central Bay	8/21/03	78	1	6	1	No	No
CB014S	Central Bay	8/21/03	72	5	7	1	.	.
CB074S	Central Bay	8/21/03	49	0	2	1	No	No
BA41	Redwood Creek	8/22/03	71	0	2	1	Yes	No
SB001S	South Bay	8/22/03	47	0	1	0	Yes	No
SB002S	South Bay	8/25/03	93	0	3	1	.	.
SB009S	South Bay	8/21/03	64	0	2	0	No	No
SB010S	South Bay	8/22/03	62	0	2	1	.	.
SB011S	South Bay	8/22/03	97	2	4	1	No	No
SB012S	South Bay	8/22/03	68	0	2	1	.	.
SB013S	South Bay	8/22/03	77	0	3	1	Yes	No
SB014S	South Bay	8/26/03	100	0	3	1	.	.

Table 4.2-4 (Continued)
Summary of Sediment Quality for the RMP In 2003

Station Code	Site Name	Date	% Fines	No. of ASC Above Guidelines	No. of ERL Above Guidelines	No. of ERM Above Guidelines	Toxic to Amphipods	Toxic to Bivalves
LSB001S	Lower South Bay	8/26/03	101	0	2	1	No	Yes
LSB002S	Lower South Bay	8/25/03	100	0	3	1	.	.
LSB009S	Lower South Bay	8/26/03	100	0	3	1	Yes	No
LSB010S	Lower South Bay	8/25/03	96	0	4	1	.	.
LSB011S	Lower South Bay	8/26/03	40	21*	2	1	No	No
LSB012S	Lower South Bay	8/25/03	98	0	3	1	.	.
LSB013S	Lower South Bay	8/25/03	98	0	3	1	No	No
LSB014S	Lower South Bay	8/25/03	100	0	3	1	.	.
BA10	Coyote Creek	8/25/03	50	0	2	0	Yes	No

Source: San Francisco Estuary Institute 2005
NA = not available, . = not tested, * = indicates number of exceedances above ASC guidelines for sandy samples.

Table 4.2-5
Physical and Chemical Test Results from Sediment Samples Taken at the Long Wharf During 1991-2001

Analyte	1991	1993	1995	1998	2001
Grain Size (percent)					
Gravel	0.0	0.0 - 0.3	0.0	0.0 - 0.1	0 - 4.6
Sand	5.5 - 12.5	7.2 - 15.8	4.0 - 11.9	2.1 - 5.6	2 - 89.5
Silt	39.9 - 45.2	42.7 - 51.2	36.6 - 49.4	33.5 - 37.9	3.9 - 37.8
Clay	45.8 - 54.5	37.6 - 44.1	45.3 - 59.4	56.5 - 64.4	0 - 66.3
Total Organic Carbon (%)	0.8	0.9	0.8 - 1.6	1.3 - 1.45	0.12 - 1.37
Metals (mg/kg)					
Antimony	<2.1 - <2.3	NA	NA	NA	NA
Arsenic	__20.1* - 29.0*__	4.8 - 7.5	9.0* - 10.1*	9.8* - 12.2*	4.3 - 9.9*
Cadmium	0.2 - 0.3	<0.1 - 0.2	0.1 - 0.2	0.3 - 0.32	0.08 - 0.31
Chromium	59.2 - 82.6*	29.3 - 46.4	77.5 - 92.2*	__126* - 135*__	26.1 - 81.4*
Copper	38.3* - 55.1*	19.8 - __75.8*__	47.5* - 57.5*	51.0* - 56.2*	5 - 44.3*
Lead	17.6 - 25.3	8.6 - 13.5	33.3 - 36.6	15.3 - 19.7	5.8 - 25.6
Mercury	0.2* - <0.23	<0.10 - 0.2*	0.2* - 0.3*	0.09 - 0.1	0.01 - 0.3*
Nickel	68.8** - 89.5**	42.8* - 49.3*	77.6** - 99.4**	103** - __113**__	25.8* - 83.5**
Selenium	0.3	<0.1 - 0.2	0.4 - __0.7__	<0.1 - __0.89__	<0.06 - 0.3
Silver	0.2 - 0.4	0.2 - 0.3	<0.088 - <0.124	0.4 - 0.45	0.023 - 0.283
Zinc	107 - 114	54.0 - 62.4	100 - 123	104 - 121	20.8 - 96.7
Butyltins (µg/kg)					
Monobutyltin	<2.1 - <2.3	<0.5 - 1.0	<2.2 - <3.1	<1	0.59 - 1.6
Dibutyltin	<2.1 - <2.3	<0.5	<2.2 - <3.1	<1	0.9 - 6.3
Tributyltin	14 - 27	<2.4 - <17	<2.2 - <3.1	<1	1.8 - 190
Tetrabutyltin	<2.1 - <2.3	<0.5	<2.2 - <3.1	<1	<0.49 - <0.82
Polycyclic Aromatic Hydrocarbons (µg/kg)					
Naphthalene	NA	<20 - __90__	<20	21 - 31	<2.3 - 22
Acenaphthylene	NA	<20	<20	<20	<1.7 - 13
Acenaphthene	NA	<20 - __85*__	<20	<20 - __32*__	<1.6 - __29*__
Fluorene	NA	<20 - __49*__	<20	<20	<1.4 - 24*
Phenanthrene	NA	<20 - 190	<20	59 - 102	4 - 150
Anthracene	NA	<20 - 49	<20	37 - 46	<1.9 - 53
Fluoranthene	NA	90 - 730*	<20 - 134	116 - 202	6 - 270
Pyrene	NA	89 - 290	<20 - 162	162 - 221	6 - 290
Chrysene	NA	42 - 120	<20	66 - 84	3 - 130
Benzo(a)anthracene	NA	29 - 110	<20	34 - 63	2 - 110
Benzo(k)fluoranthene	NA	23 - 66	<20	49 - 78	3 - 110
Benzo(b)fluoranthene	NA	38 - 170	<20	48 - 75	2 - 110
Benzo(a)pyrene	NA	48 - 210	<20	70 - 105	4 - 180
Indeno(1,2,3-cd)pyrene	NA	39 - 130	<20	33 - 57	4 - 150
Dibenzo(A,H)Anthracene	NA	<20	<20	<20	<2.1 - 18
Benzo(g,h,i)perylene	NA	38 - 120	<20	26 - 74	3 - 140
2-Methylnaphthalene	NA	NA	NA	NA	<3.1 - 11
Dibenzofuran	NA	NA	NA	NA	<1.4 - 13
Total PAHs	NA	748 - 1899	<20 - 296	764 - 1095	35 - 1773

Table 4.2-5 (Continued)
Physical and Chemical Test Results from Sediment Samples Taken at the Long Wharf During 1991-2001

Analyte		1991	1993	1995	1998	2001
Physical and Chemical Test Results from Sediment Samples Taken at the Long Wharf during 1991-2001. (Cont.)						
Pesticides (µg/kg)						
4,4'-DDD		NA	<25	<2	<1 - 2	0 - 3
4,4'-DDE		NA	<12	<2	1 - 2	1 - 2
4,4'-DDT		NA	<25	<2	<2	<0.35 - **7***
Aldrin		NA	<12	<2	<2	<0.30 - <0.82
alpha-BHC		NA	<6.2	<2	<2	<0.21 - <2.2
beta-BHC		NA	<12	<2	NA	<0.19 - <0.32
Chlordane		NA	<120	<25	<2 - 3	NA
Chlordane-alpha		NA	NA	NA	<2	<0.22 - <1.1
Chlordane-gamma		NA	NA	NA	<2	<0.19 - <2.2
delta-BHC		NA	<12	<2	<2	<0.47 - <0.79
Dieldrin		NA	<12	<2	<2	<0.39 - <0.66
Endosulfan I		NA	<12	<2	<2	<0.16 - <0.81
Endosulfan II		NA	<25	<2	<2	<1.1 - <4.3
Endosulfan Sulfate		NA	<25	<25	<2	<0.21 - <0.35
Endrin		NA	<12	<2	<2	<0.27 - <1.3
Endrin Aldehyde		NA	<31	<10	<2	<0.45 - <0.76
Heptachlor		NA	<12	<2	<2	<0.17 - <0.29
Heptachlor Epoxide		NA	<12	<10	<2	<0.18 - <0.29
gamma-BHC (Lindane)		NA	<6.2	<2	<2 - 4	<0.31 - <0.52
Toxaphene		NA	<500	<25	<2	<7.1 - <12
Endrin Ketone		NA	NA	NA	NA	<0.20 - <0.34
Methoxychlor		NA	NA	NA	NA	<0.21 - <0.34
Total DDTs		NA	NA	NA	NA	1 - 8
Polychlorinated biphenyls (µg/kg)						
Arochlor 1016		NA	<250	<20	<10	<3 - <5.1
Arochlor 1221		NA	<250	<20	<10	<3 - <5.1
Arochlor 1232		NA	<250	<20	<10	<3 - <5.1
Arochlor 1242		NA	<250	<20	<10	<3 - <5.1
Arochlor 1248		NA	<250	<20	<10	<3 - <5.1
Arochlor 1254		NA	<250	<20	<10	8 - **45***
Arochlor 1260		NA	<250	<20	<10	<3 - 9
Total PCBs		NA	<250	<20	<10	8 - **45***

*** = exceeds ER-L (Effects Range - Low).**
**** = exceeds ER-M (Effects Range - Median).**
bold = exceeds Ambient Sediment Concentration for San Francisco Bay.
Source: Chevron 2002

Table 4.2-6
Summary of Composite Testing Results at Berths 1, 2, 3, 4, 5 and Bargeway
Long Wharf 2005, Richmond, California

		SAMPLE LOCATION						
Analyte[a]	**Alcatraz Environs Database[b]**	**1-COMP**	**2/3-COMP**	**4-COMP**	**5-COMP**	**BD051705[d]**	**B-I-COMP**	**B-II-COMP**
Polycyclic Aromatic Hydrocarbons (PAHs) (µg/kg)								
Naphthalene	NA	11	51	2.9 J	17	12	16	14
2-Methylnaphthalene	NA	3.7 J	18	2.1 J	10	4.6 J	6.6	5.8
Acenaphthylene	NA	6.3	16	8.5	7.7	7.3	13	14
Acenaphlthene	NA	5.5	**110***	5.9	**34***	7.0	9.8	7.5
Fluorene	NA	6.3	**55***	7.4	20*	9.5	13	9.0
Dibenzofuran	NA	2.8 J	43	2.0 J	11	4.3 J	5.7	3.0 J
Phenanthrene	NA	52	220	80	62	70	110	110
Anthracene	NA	18	81	24	23	56	36	37
Fluoranthene	NA	110	430	170	150	230	290	230
Pyrene	NA	130	400	210	220	210	330	280
Benzo(b)fluoranthene	NA	45	170	78	80	77	130	99
Benzo(k)fluoranthene	NA	44	120	71	67	66	100	86
Benzo(a)anthracene	NA	50	180	71	60	54	110	96
Chrysene	NA	59	210	87	83	100	140	120
Benzo(a)pyrene	NA	71	200	130	110	94	180	160
Indeno(1,2,3-cd)pyrene	NA	61	160	120	100	87	160	140
Dibenzo(a,h)anthracene	NA	7.1	23	12	9.6	11	21	18
Benzo(g,h,i)perylene	NA	59	140	120	100	83	160	140
Total PAHs[c]	642	742	2,627	1,202	1,164	1,183	1,831	1,569
Organotins (µg/kg)								
Tetrbutyltin	NA	<2.1	0.70 J	<2.1	<2.1	<2.0	<2.0	<2.0
Tributyltin	1.05	2.7	130	1.8 J	1.8 J	1.7 J	1.4 J	2.8
Dibutyltin	0.6	0.96 J	4.6	2.4	1.3 J	1.3 J	1.3 J	2.0 J
Monobutyltin	NA	0.36 J	1.1 J	0.46 J	0.86 J	0.57 J	0.35 J	0.71 J
Solids (percent – wet weight)								
Total Solids	NA	48.3	48.7	48.6	48.4	49.9	51.1	51.2
Grain Size (percent)								
Gravel	4.8	7.8	0.2	0.0	0.0	0.2	2.0	0.0
Sand	92.2	5.8	7.5	7.7	3.6	3.1	6.3	5.8
Silt	1.2	45.6	51.0	47.5	52.2	49.2	48.7	52.4
Clay	1.8	42.9	38.1	45.0	48.8	47.6	36.8	39.8

*** = exceeds ER-L (Effects Range-Low)**
Bold = exceeds Ambient Sediment Concentration for San Francisco Bay
Source: Chevron

Tissues

The RMP conducts bivalve monitoring in San Francisco Estuary to measure contaminant accumulation during the dry season as a measure of potential bioavailability of contaminants of concern. Bivalves bioaccumulate chemical contaminants through their food by ingesting sediment and assimilating contaminants that are sorbed to particles, and by filtering dissolved contaminants directly from the water column (San Francisco Estuary Institute 2005). Bivalves are transplanted to various stations to measure bioaccumulation. Mussels are transplanted in cages and left for 90 to 100 days. Chemical analyses of tissue burden are performed prior to deployment and after deployment to determine the accumulation factor (accumulation factor =AF= after deployment/prior to deployment). In 2003, transplanted individuals of the California mussel (*Mytilus californianus*) were used at all stations. The 2003 bivalve monitoring stations included a station at Red Rock near the Long Wharf.

The mussels deployed at the Red Rock station in August of 2003 had a survival of 98 percent. The highest accumulation factor was 24 for total PCBs. The Red Rock mussels had accumulation factors of 1.2 for dieldrin, 2 for total DDTs and 14.3 for PBDEs. An accumulation factor greater than 1 means that the contaminant was higher in the mussel tissue after the deployment period compared to before. None of the contaminants in the Red Rock mussel tissues exceeded the screening values calculated according to USEPA guidelines for the protection of human health.

A 1994 pilot study of contaminant levels in San Francisco Bay fishes commonly caught by anglers indicated that PCBs, mercury, dieldrin, chlordanes, DDTs, and dioxins were at levels that posed human health concerns (RWQCB, SWRCB, and CDFG 1995). High levels of the pesticides dieldrin, DDT, and chlordane were most often found in fishes from the North Bay. Levels of PCBs, mercury and dioxins were found at elevated levels throughout San Francisco Bay. In 2000, the RMP analyzed mercury, selenium, and trace organic contaminant concentrations in seven sport fish species from San Francisco Bay (Greenfield et al. 2003). As in previous sampling, fish samples exceeded human health screening values for most monitored contaminants. With the exception of chlordanes, every contaminant sampled in finfish in 2000 exhibited some screening value exceedances. Screening values were exceeded for PCBs, dioxin toxic equivalents, mercury, dieldrin, selenium and DDTs. Many fish samples also contained detectable residues of the flame retardant compounds, PBDEs. PCB concentrations exceeded the screening value in almost every fish sampled. In general, Oakland and South Bay Bridges were relatively high in contaminant concentrations while Berkeley and San Pablo Bay were relatively low.

Clam and crab samples also were analyzed in the 2000 study. For most contaminants clam tissue and crab muscle tissue had lower concentrations than monitored sport fish, indicting that consumption of these shellfish is not as significant an exposure route to humans as are monitored sport fish.

Outer Coast

The project area includes the coast of California, Oregon, and Washington, because tankers using Long Wharf transit the west coast of the United States as well as travel to foreign ports. The California Current establishes water quality along the west coast of the United States. In sharp contrast to the fast, narrow Hiroshima Current on the other side of the Pacific Ocean, the California Current is a broad, slow-moving current that transports cold, low-salinity water from the Pacific Northwest southward. As compared to the east coast of the United States, the west coast water is much cooler, of lower salinity, and has more nutrients and plankton.

During the spring, strong northwest winds blow down the west coast. This results in upwelling of cool, clear bottom water with many nutrients and relatively low dissolved oxygen concentrations. North of the San Francisco Bay Area, the coastline is not heavily populated and the water quality is deemed to be good (Winzler and Kelly 1977, Rasmussen 1995). North coast waterbodies on the State 303(d) list of impaired waterbodies consist of rivers and bays, and contaminants are primarily sedimentation and nutrients from pasture land and forestry (SWRCB 2003). Watersheds that drain directly into marine waters can locally influence the temperature, salinity, dissolved oxygen, and turbidity characteristics of coastal waters, as well as contribute to the sediment and contaminant loadings of the waters. Many streams and rivers in the north coast area carry substantial sediment loads during the winter rainy season. Currently, most of the reported water quality problems within the North Coast Basin are intermittent or transitory; hence, in general, the present water quality meets or exceeds the water quality objectives set forth in the Water Quality Control Plan for the North Coast Region (RWQCB 1993).

Water quality in northern coastal California is also affected by municipal and industrial discharges (primarily timber industry and power), nonurban runoff, harbors, and vessel traffic. Water quality in this area is described in detail in Chambers Group, 1994. The central coast of California is somewhat populated and water quality is affected by municipal and industrial discharges (cooling water), nonurban runoff, harbors, and vessel traffic. Principal urban areas between San Francisco and Point Conception are the Santa Cruz/Monterey area, San Luis Obispo, and the Pismo Beach area.

At Point Conception, the orientation of California's coastline changes from north/south north of Point Conception to east/west in the Santa Barbara Channel. Point Conception is the northern boundary of the Southern California Bight, which extends to the U.S./Mexico Border. A section of the slow, southerly flowing California Current turns left in the Southern California Bight and forms the Southern California Counter Current, which flows close to the continental shelf break in a northwest direction. These currents intercept each other at the western end of Santa Barbara Channel and result in a counter clockwise gyre in Santa Barbara Channel (Brown and Caldwell 1991). Southern California is an extensive urban area with numerous municipal and industrial discharges. The Santa Monica Bay and Palos Verdes coastal areas off Los Angeles County are on the State 303(d) list of impaired waterbodies for a wide variety of contaminants related to historic sewage discharges and urban runoff (SWRCB 2003). A detailed description of water quality in southern California is presented in Aspen Environmental Group 1992.

4.2.2 Regulatory Setting

The regulatory setting includes laws, regulations, plans, polices, and programs at the Federal, State, local, and regional levels. Specific laws and regulations are referenced later in the text, and provide the underlying basis for plans, policies, and programs.

Federal Policies

The Federal Clean Water Act (CWA) (35 U.S.C. 1251 et. seq.) delegates certain responsibilities in water quality control and water quality planning to the states. In California, the California Environmental Protection Agency (Cal EPA) and the State Water Resources Control Board (SWRCB) agreed to such delegation and regional boards implement portions of the CWA, such as the issuance of National Pollution Discharge Elimination System (NPDES) permits. The aim of the CWA of 1977 (33 U.S.C. 1251 et seq.) is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Specific sections control the discharge of wastes into marine and aquatic environments. CWA Section 402 states that discharge of pollutants to waters of the United States is unlawful unless the discharge is in compliance with an NPDES permit. CWA Section 404 establishes a permit program to regulate the filling of jurisdictional waters including the discharge of dredged material into waters of the United States. The U.S. Army Corps of Engineers (Corps) has jurisdictional authority pursuant to CWA Section 404. The EPA assists the Corps in evaluating environmental impacts of dredging and filling, including water quality and historic and biological values. CWA Section 401 requires that activities permitted under Section 404 must not cause concentrations of chemicals in the water column to exceed State standards. CWA Section 303(d) requires that states develop a list of waterbodies that need additional work beyond existing controls to achieve or maintain water quality standards. The additional work includes the establishment of total maximum daily loads (TMDLs) of pollutants that have impaired the waterbody.

The National Estuary Program was established in 1987 by amendments to the CWA to identify, restore, and protect nationally significant estuaries of the United States. The San Francisco Estuary Project is one of over 20 Estuary Projects established by the National Estuary Program. The San Francisco Estuary Project is a cooperative Federal, State, and local program to promote effective management of the San Francisco Bay-Delta Estuary.

The Coastal Zone Management Act of 1972 (16 U.S.C. 1455 et. seq.) regulates development and use of the nation's coastal zone by encouraging states to develop and implement coastal zone management programs. Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA) (16 U.S.C. 1455b) required the coastal states with Federally approved coastal zone management plans to develop and submit coastal nonpoint source pollution control programs for approval by the National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protection Agency (EPA). Long-range planning and management of California's coastal zone were conferred to the State with implementation of the California Coastal Act of 1976.

State Plans and Policies

The quality of California's coastal environment is protected under the California Coastal Act, which established the California Coastal Commission (CCC). Several provisions of the California Coastal Act serve to protect coastal water quality from point and nonpoint source pollution. The McAteer-Petris Act governs planning and management of the San Francisco Bay portion of the California Coastal Management Program. The McAteer-Petris Act established the San Francisco Bay Conservation and Development Commission (BCDC) as the agency responsible for protection of San Francisco Bay that includes critical and sensitive Bay areas. Sensitive areas near the proposed Project are identified in Section 4.2.1, Environmental Setting.

The California Porter-Cologne Water Quality Control Act of 1969 established the SWRCB and nine Regional Water Quality Control Boards (RWQCB) as the principal State agencies with primary responsibility for the coordination and control of water quality. The SWRCB is generally responsible for setting statewide water quality policy. Each RWQCB makes water quality and regulatory decisions for its region. In 1991, the SWRCB and RWQCBs were brought together with five other State environmental protection agencies under the newly crafted California Environmental Protection Agency. Measures to protect and restore the quality of California's coastal water also are addressed in the State's Plan for California's Nonpoint Source Pollution Control Program, which the State prepared pursuant to both the CWA and the CZARA.

The Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) (RWQCB 1995) is the primary policy document that guides the RWQCB, San Francisco Bay Region. Established under the requirements of the 1969 Porter-Cologne Water Quality Control Act, the Basin Plan was originally adopted in April 1975, and the most recent revisions were adopted in 1995 and approved by the EPA in 2000. In January of 2004 amendments to the Basin Plan were adopted that included application of California Toxic Rule water quality criteria and definitions in lieu of Basin Plan water quality objectives, update of Basin Plan provisions relating to implementation of water quality standards, and several non-regulatory updates. The Basin Plan applies to point and nonpoint sources of waste discharge to the Bay, but not to vessel wastes or the control of dredge material disposal or discharge. The Basin Plan assigns beneficial uses to all waters in the basin. These beneficial uses include municipal, industrial, and agricultural water supply; freshwater replenishment and groundwater recharge; water contact and noncontact recreation; navigation; commercial and sport fishing; shellfish harvesting; marine, estuary, wildlife, and warm and cold freshwater habitat; preservation and enhancement of Areas of Biological Significance; and rare and endangered species, wildlife, fish migration, and fish spawning. The Basin Plan also sets water quality objectives, subject to approval by the EPA, intended to protect designated beneficial uses. The water quality objectives in the Basin Plan are written to apply to specific parameters (numeric objectives) and general characteristics of the water body (narrative objectives). The water quality objectives are achieved primarily through effluent limitations embodied in the NPDES program.

The San Francisco Bay Region RWQCB has NPDES permit authority on any facility or activity that discharges waste into the Bay. Effluent limits are contained within the NPDES permit; the discharge of process wastewater containing constituents in excess of the limits stated within the NPDES permit is prohibited.

The California Marine Invasive Species Act (MISA) of 2003 (Public Resources Code sections 71200 through 71271), which became effective January 1, 2004, revised and expanded the Ballast Water Management for Control of Nonindigenous Species Act of 1999. (See Appendix E for key components of the Act.) The MISA specifies mandatory mid-ocean exchange or retention of all ballast water for vessels carrying ballast water into California waters after operating outside the US EEZ. For vessels coming from other west coast ports, the act requires minimization of ballast water discharges in state. However, beginning March 22, 2006, all vessels operating within the Pacific Coast Region will be required to manage ballast water. Management options include retention of all ballast water, exchange of ballast water in near-coastal waters, before entering the waters of the state, if that ballast water has been taken on in a port or place or within the Pacific Coast region. All vessels are required to complete and submit a ballast water reporting form, maintain a vessel-specific ballast water management plan and ballast tank log book, remit the necessary fee to the Board of Equalization, and submit to compliance verification inspections.

The California Clean Coast Act (SB 771) went into effect January 1, 2006, and has several requirements to reduce pollution of California waters from large vessels. The California Clean Coast Act prohibits the operation of shipboard incinerators within 3 miles of the California coast, prohibits the discharge of hazardous wastes, other wastes or oily bilgewater into California waters or a marine sanctuary, prohibits the discharge of graywater and sewage into California waters from vessels with sufficient holding tank capacity or vessels capable of discharging graywater and/or sewage to available shoreside reception facilities, requires reports of prohibited discharges to the California State Water Resources Board, and submission of an information report to the California State Lands Commission (CSLC).

The CSLC issues dredging permits for projects that propose to dredge in State-owned submerged lands, tidelands, and marshes. In addition, any project sponsor seeking to use State-owned lands for right-of-way uses must obtain a land use lease from the CSLC. For each of these discretionary decisions, the CSLC bases its decision on information presented in environmental documentation prepared pursuant to the requirements of the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA).

Local and Regional Plans and Water Quality Policies and Programs

The BCDC's San Francisco Bay Plan, adopted in 1968, provides policies to guide future uses of the Bay and shoreline. BCDC regulates all Bay dredging and filling to protect marshes, wetlands, and other resources of the Bay. Its jurisdiction includes all areas of the Bay below the line of highest tidal action as well as 100 feet inland from the line of highest tidal action. Policies within the Plan indicate that "pipeline terminal and distribution facilities near the Bay should generally be located in industrial areas" and that "marine terminals should also be shared as much as possible among industries and port uses."

The Long-Term Management Strategy (LTMS) for Placement of Dredged Materials in the San Francisco Bay region is a cooperative effort of the EPA, the Corps, SWRCB, the RWQCB, and the BCDC to develop a new approach to dredging and dredged material disposal in the San Francisco Bay area. The major goals of the LTMS are to:

1. maintain, in an economically and environmentally sound manner, those channels necessary for navigation in the San Francisco Bay and Estuary while eliminating unnecessary dredging activities;

2. conduct dredged material disposal in the most environmentally sound manner;

3. maximize the re-use of dredged material as a resource; and

4. establish a cooperative permitting framework for dredging and disposal of dredged materials.

The LTMS agencies completed a Final Policy Environmental Impact Statement (EIS)/Programmatic Environmental Impact Report (EIR) (October 1998), proposing the new long-term plan for achieving these goals. The new approach calls for reducing disposal within San Francisco Bay over time, and increasing recycling of dredged material for "beneficial uses," including habitat restoration, levee maintenance, and construction fill. The LTMS agencies have also established an interagency Dredged Material Management Office (DMMO), which serves as a "one stop shop" for Bay Area dredging permit applications. In July of 2001 the LTMS agencies issued the Long-term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region Management Plan 2001 (USACE, USEPA, BCDC, and SWBRWQCB 2001). This Management Plan presents specific mechanisms to implement the long-term dredging, disposal and beneficial reuse strategy.

The CALFED Bay-Delta Program was formed to resolve conflicts over freshwater uses in the Bay Delta. The mission of the CALFED Bay-Delta Program is to develop a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta System. State-Federal cooperation was formalized in June 1994 with the signing of a Framework Agreement by the State and Federal agencies with management and regulatory responsibility in the Bay-Delta Estuary. The CALFED agencies are:

- State: Resources Agency, Department of Water Resources, California Department of Fish and Game (CDFG), Cal EPA, SWRCB, and CSLC; and

- Federal: Bureau of Reclamation, U.S. Fish and Wildlife Service (USFWS), EPA, Department of Commerce, NOAA Fisheries, the Corps, Department of Agriculture, and Natural Resources Conservation Service.

These agencies provide policy direction and oversight for the process.

The Framework Agreement pledged that the State and Federal agencies would work together in three aspects of Bay-Delta management: (1) water quality standards formulation, (2) coordination of State Water Project and Central Valley Project operations with regulatory requirements, and (3) long-term solutions to problems in the Bay-Delta Estuary.

Objectives and Criteria

To protect beneficial uses, the RWQCB has established objectives for waters covered by the San Francisco Basin Plan. Table 4.2-7 lists the narrative objectives for San Francisco Bay waters.

For ocean waters, the State Water Resources Control Board has established objectives for the protection of aquatic life. These objectives are specified in the California Ocean Plan (SWRCB 2001). Those objectives are listed in Table 4.2-8. Water quality criteria for priority toxic pollutants for California inland surface waters, enclosed bays, and estuaries were established by the California Toxics Rule (USEPA 2000). Table 4.2-9 shows the California Toxic Rule criteria.

At this time, no standards for the protection of aquatic organisms for chemical levels in sediments have been set. NOAA has published effects-based sediment quality values for evaluating the potential for contaminants in sediment to cause adverse biological effects (Long and Morgan 1990, Long et al. 1995). These values are commonly used as guidelines to evaluate sediment contaminant concentrations. These values are referred to as Effects Range-Low (ER-L) and Effects Range-Medium (ER-M) (Long and Morgan 1990, Long et al. 1995). This tool for comparing sediment quality was developed for NOAA based on tests of toxicity of sediments to benthic organisms. In these tests, effects were rarely seen below the ER-L. Therefore, at chemical concentrations below the ER-L, effects are unlikely. Effects were usually seen above the ER-M. Thus, the ER-M is the concentration at which effects are probable. Table 4.2-10 shows these sediment criteria.

Table 4.2-7
Select Water Quality Objectives from the San Francisco Bay Basin Plan

Parameter	Objective
Bioaccumulation	Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life.
Biostimulatory Substances	Waters shall not contain biostimulatory substances in concentrations that promote aquatic growth to the extent that such growths cause nuisance or adversely affect beneficial uses.
Color	Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses.
Dissolved Oxygen (Do)	For all tidal waters, the following objectives shall apply: in the bay, downstream of Carquinez bridge 5.0 mg/l minimum, upstream of Carquinez bridge 7.0 mg/l minimum.
Floating Material	Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.
Oil And Grease	Waters shall not contain oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.
Population And Community Ecology	All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce significant alteration in population, community ecology or receiving water biota.
PH	The pH shall not be depressed below 6.5 nor raised above 8.5.
Salinity	Controllable water quality factors shall not increase the total dissolved solids or salinity of waters of the State so as to adversely affect beneficial uses, particularly fish migration and estuarine habitat.
Sediment	The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses. Controllable water quality factors shall not cause a detrimental increase in the concentrations of toxic pollutants in sediments or aquatic life.
Settleable Material	Waters shall not contain substances in concentrations that result in the deposition of material that cause nuisance or adversely affect beneficial uses.
Sulfide	All water shall be free from dissolved sulfide concentrations above natural background levels.
Suspended Material	Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.
Taste And Odor	Waters shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin, that cause nuisance, or that adversely affect beneficial uses.
Temperature	Temperature objectives for enclosed bays and estuaries are as specified in the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California," any aquatic habitat shall not be increased by more than 5° F above natural temperatures.
Toxicity	All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms.
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases from normal background light penetration or turbidity relatable to waste discharge shall not be greater than 10 percent in areas where natural turbidity is greater than 50 ntu.
Un-Ionized Ammonia	The discharge of wastes shall not cause receiving waters to contain concentrations of un-ionized ammonia in excess of the following limits: annual median 0.025 mg/l, maximum (central bay and upstream) 0.16 mg/l.

Source: RWQCB (1995). Water Quality Control Plan San Francisco Bay Basin (Region 2).

Table 4.2-8
California Ocean Plan Toxic Materials Limitations

Constituent	Limiting Concentrations			
	Units of Measurement	**6-Month Median**	**Daily Maximum**	**Instantaneous Maximum**
Arsenic	pg/L	8	32	80
Cadmium	pg/L	1	4	10
Chromium (Hexavalent)	pg/L	2	8	20
Copper	pg/L	3	12	30
Lead	pg/L	2	8	20
Mercury	pg/L	0.04	0.16	0.4
Nickel	pg/L	5	20	50
Selenium	pg/L	15	60	150
Silver	pg/L	0.7	2.8	7
Zinc	pg/L	20	80	200
Cyanide	pg/L	1	4	10
Total Chlorine Residual	pg/L	2	8	60
Ammonia (expressed as nitrogen)	pg/L	600	2400	6000
Chronic Toxicity	Tuc		1	
Phenolic Compounds (non-chlorinated)	pg/L	30	120	300
Chlorinated Phenolics	pg/L	1	4	10
Endosulfan	ng/L	9	18	27
Endrin	ng/L	2	4	6
HCH	ng/L	4	8	12

Radioactivity: Not to exceed limits specified in Title 17, Division 1, Chapter 5, Subchapter 4, Group 3, Article 3, Section 30269 of the California Code of Regulations.
Source: SWRCB 2001. California Ocean Plan.

Table 4.2-9
California Toxics Rule Toxic Materials Concentrations for Saltwater

Constituent	Criterion Maximum Concentration (pg/L)	Criterion Continuous Concentration (pg/L)
Arsenic	69	36
Cadmium	42	9.3
Chromium (VI)	1100	50
Copper	4.8	3.1
Lead	210	8.1
Mercury*	2.1	0.025
Nickel	74	8.2
Selenium	290	71
Silver	1.9	
Zinc	90	81
Cyanide	1	1
Pentachlorophenol	13	7.9
Aldrin	1.3	
gamma-BHC	0.16	
Chlordane	0.09	0.004
4,4'-DDT	0.13	0.001
Dieldrin	0.71	0.0019
alpha-Endosulfan	0.034	0.0087
beta-Endosulfan	0.034	0.0087
Endrin	0.037	0.0023
Heptachlor	0.053	0.0036
Heptachlor Epoxide	0.053	0.0036
PCB-1242		0.03
PCB-1254		0.03
PCB-1221		0.03
PCB-1232		0.03
PCB-1248		0.03
PCB-1260		0.03
PCB-1016		0.03
Toxaphene	0.21	0.0002

pg/L = micrograms per liter.
*** = National Toxics Rule 1997, not yet established by California Toxics Rule**
Source: USEPA 2000

Table 4.2-10
Sediment Effects Guideline Values

Parameter	Effects Range-Low (ER-L)	Effects Range-Median (ER-M)
Metals (mg/Kg)		
Antimony	2.0	2.5
Arsenic	8.2	70
Cadmium	1.2	9.6
Chromium	81	370
Copper	34	270
Lead	46.7	218
Mercury	0.15	0.71
Nickel	20.9	51.6
Silver	1	3.7
Zinc	150	410
Organics (μg/Kg)		
Acenaphthene	16	500
Acenaphthylene	44	640
Anthracene	85.3	1100
Fluorene	19	540
2-Methyl naphthalene	70	670
Naphthalene	160	2100
Phenanthrene	240	1500
Low-molecular weight PAH	552	3160
Benz(a)anthracene	261	1600
Benzo(a)pyrene	430	1600
Chrysene	384	2800
Dibenzo(a,h)anthracene	63.4	260
Fluoranthene	600	5100
Pyrene	665	2600
High molecular weight PAH	1700	9600
Total PAH	4022	44792
p,p'-DDE	2.2	27
Total DDT	1.58	46.1
Total PCBs	22.7	180

ER-L = Concentration at lower tenth percentile at which adverse biological effects were observed or predicted.
ER-M = Concentration at which adverse biological effects were observed or predicted in 50% of test organisms.
mg/Kg – milligrams per kilogram.
μg/Kg – micrograms per kilogram
Source: Long et al. 1995.

Finally, as a way of evaluating sediment contamination within San Francisco Bay, the San Francisco Estuary Institute has compiled thresholds of ambient sediment concentrations based on the cleanest portions of San Francisco Bay (Gandesbery et al. 1999). These thresholds, shown in Table 4.2-11, recognize that no part of San Francisco Bay is free of anthropogenic inputs of contaminants, but these thresholds provide a relative measure of comparing sediment contaminant concentrations within the Bay. As shown in Table 4.2-11 even ambient metal concentrations in different size particles of sediment in San Francisco Bay exceed the ER-L concentration for arsenic, chromium, mercury, and total DDT. Sediments with greater than 40 percent fines content exceed the ER-L for copper, acenaphthylene, anthracene, fluorene, and high molecular weight PAHs. Both fine and coarser sediments exceed the ER-M for nickel.

4.2.3 Impact Significance Criteria

The significance of impacts was considered in the context of whether the Long Wharf's operations would likely result in pollutant levels above ambient water quality and sediment levels and whether increased levels would exceed water quality objectives of the RWQCB or the SWRCB. The significance of impacts was considered in the context of contaminant levels for San Francisco Bay in general and the project area in particular. For example, operations that would result in changes from background that are not discernible in the local area, or region were considered less than significant impacts.

Impacts to marine water quality were considered significant if any of the following apply:

- The water quality objectives contained in the Water Quality Control Plan for San Francisco Basin (RWQCB 1995) (Table 4.2-7) are exceeded;

- The WQC in the California Toxics Rule (EPA 2000) (Table 4.2-8) are exceeded; and/or

- Project operations or discharges that change background levels of chemical and physical constituents or elevate turbidity would produce long-term changes in the receiving environment of the site, area, or region that would impair the beneficial uses of the receiving water.

Impacts are considered adverse, but less than significant (Class III) if the project could result in elevation of contaminants, but the levels remain below WQC, or if elevation of contaminant concentrations above criteria occurs only within a couple of hundred feet or less of the point of discharge for a few hours or less.

Table 4.2-11
Sediment Thresholds for San Francisco Bay

Analyte	SF Estuary Sediment Ambient Concentration (dry wt.) [p=.85]		ERL[1] (dry wt.)	ERM[2] (dry wt.)
	<40 % fines	40-100 % fines		
Metals (ppm) (HNO3/HCl Digestion)				
Arsenic	13.5	15.3	8.2[1]	70[2]
Cadmium	0.25	0.33	1.2	9.60
Chromium	91.4	112	81	370
Copper	31.7	68.1	34	270
Lead	20.3	43.2	46.7	218
Mercury	0.25	0.43	0.15	0.71
Nickel	92.9	112	20.9	51.6
Selenium	0.59	0.64		
Silver	0.31	0.58	1	3.7
Zinc	97.8	158	150	410
Organic Compounds (ppb)				
Chlordanes, total	0.42	1.1		
Dieldrin	0.18	0.44		
HCH, total	0.31	0.78		
HCB, total	0.19	0.48		
DDTs, total 6 isomers	2.8	7	1.58	46.1
PCBs, total	5.9	14.8	22.7	180
PCBs, total (SFEI 40 list)	8.6	21.6		
1-Methylnaphthalene	6.8	12.1		
1-Methylphenanthrene	4.5	31.7		
2,3,5-Trimethylnaphthalene	3.3	9.8		
2,6-Dimethylnaphthalene	5	12.1		
2-Methylnaphthalene	9.4	19.4	70	670
Acenaphthene	11.3	26.6	16	500
Acenaphthylene	2.2	31.7	44	640
Anthracene	9.3	88	85.3	1,100
Benz(a)anthracene	15.9	244	261	1,600
Benzo(a)pyrene	18.1	412	430	1,600
Benzo(b)fluoranthene	32.1	371		
Benzo(e)pyrene	17.3	294		
Benzo(g,h,i)perylebe	22.9	310		
Benzo(k)fluoranthene	29.2	258		
Organic Compounds (ppb)				
Biphenyl	6.5	12.9		
Chrysene	19.4	289	384	2,800
Dibenz(a,h)anthracene	3	32.7	63.4	260
Fluoranthene	78.7	514	600	5,100
Fluorene	4	25.3	19	540
Indeno(1,2,3-c,d)pyrene	19	382		
Naphthalene	8.8	55.8	160	2,100
Perylene	24	145		
Phenanthrene	17.8	237	240	1,500
Pyrene	64.6	665	665	2,600
High molecular weight PAHs, total	256	3,060	1,700	9,600

Table 4.2-11 (continued)
Sediment Thresholds for San Francisco Bay

Analyte	SF Estuary Sediment Ambient Concentration (dry wt.) [p=.85]		ERL[1] (dry wt.)	ERM[2] (dry wt.)
	<40 % fines	40-100 % fines		
Low molecular weight PAHs, total	37.9	434	552	3,160
PAHs, total	211	3,390	4,022	44,792

Source: Gandesbery et al. 1999.
[1] ER-L = Effects Range Low.
[2] ER-M = Effects Range Median.

4.2.4 Impacts Analysis and Mitigation Measures

4.2.4.1 Long Wharf Routine Operations and Potential for Accident Conditions

The Long Wharf connects the Refinery and ships transporting crude oil and processed products. The Long Wharf typically receives about 98 million bbls of crude oil, diesel fuel oil, gasoline components, plant feed stocks, diesel blend stock, and dirty diesel/flush stock annually. Of this amount, approximately 80 million bbls per year are crude oil of both domestic and foreign origin. The Long Wharf typically ships approximately 35 million bbls annually of gasoline, gasoline components, aviation fuel, jet fuel, diesel fuel, and lubricating oils. Numerous pipelines supported by the pipeline trestle are used to transport fluids between the vessels and the Refinery as described in Section 2.0, Project Description. In addition, other utility pipelines handle potable water, firewater, nitrogen, natural gas, steam, sanitary waste, and electricity.

Impact WQ-1: Sediment Disturbance to Water Quality from Vessel Maneuvers

Disturbed sediments could cause a brief, localized increase in turbidity and depression in dissolved oxygen concentrations, but would disperse rapidly with the strong tidal currents in the area, and be rapidly mitigated by tidal mixing with Bay waters of high dissolved oxygen concentration. Such events would occur for an hour or less during a 24-hour period and be limited to the immediate vicinity of the Long Wharf, thus increased turbidity due to vessel traffic would be adverse, but less than significant (Class III).

On average, 75 vessels (35 tankers and 40 barges) per month call on the Long Wharf. For the year 2004, actual vessel calls averaged 30.5 ships (all tankers) and 33.1 barges. These vessels and barges are assisted by tugs in berthing and unberthing operations. The number of tugs used in docking or maneuvering of vessels is dependent on the size of the vessel and environmental conditions. The number can vary from one to as many as four. Berthing operations can affect water quality by propeller wash from tankers and tugs eroding bottom sediments in the immediate vicinity of the Long Wharf. Strong tidal currents occur in the vicinity of the Long Wharf. The ship's propulsion system is used to compensate for the tidal current and head winds. The large propellers on tankers of large drafts are close to the bottom of the Bay and the turbulence from these propellers can erode bottom sediments. The transit of deep-draft vessels through San Francisco Bay to the Long Wharf can also resuspend sediments and benthic biota in the water column where bottom depths are near that of the vessel draft. The propeller wash from tugs is nearer the surface and has less of an erosion effect on bottom sediments.

Berth depths at the Long Wharf range between 15 and 50 feet MLLW (see Table 2.3-1). The deepest berth (50 feet) is Berth 4. The maximum draft of vessels using the Long Wharf is 44 feet. These largest tankers use Berth 4.

Sediment grain size analyses at the Long Wharf were conducted prior to dredging in 1991, 1993, 1995, 1998, 2001 and 2005 (see Table 4.2-5 and 4.2-6). The sediments were primarily silts and clay. Velocities in excess of 125 centimeters per second (cm/sec) are required to scour silts and clays compared to 25 cm/sec for fine grain sand (Hjulstrom 1939). Therefore, bottom scouring at the Long Wharf during berthing would be lower than would occur in areas of fine sand due to the nature of the sediments.

The resuspension of bottom material from propeller wash and bow thrusters can affect turbidity in the immediate vicinity of vessel operations. The San Francisco Bay Basin Plan contains a water quality objective that specifies that waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses (RWQCB 1995). The Basin Plan objective for dissolved oxygen states that for tidal waters downstream of Carquinez Bridge, dissolved oxygen shall not be depressed below 5 mg/l.

A turbid plume of water is often evident in turbulent propeller wash of large deep-draft vessels in relatively shallow harbors and bays. This turbid plume would be short-lived. Observations of turbidity caused by boat wakes indicate that the plume generally persists less than 10 minutes. Depending on the depth of propeller wash scour, sediments might be anaerobic and could cause a brief, localized depression in dissolved oxygen concentrations. This resuspended sediment material would disperse rapidly with the strong tidal currents in the area and any depression in dissolved oxygen would be rapidly mitigated by tidal mixing with Bay waters of high dissolved oxygen concentration.

Bottom scour conditions are likely to occur when deep-draft vessels are using their propulsion systems while berthing at the Long Wharf. On average, 35 tankers and 40 barges, along with their associated tugboats, per month call at the Long Wharf and it takes about 1 hour to secure the vessel on barge to the dock. Therefore, these conditions would occur approximately 20 percent of the time on average [(1 hour for vessel arriving + 1 hour for vessel departing) x (75 vessels per month)/ (732 hours per month) = 20.5 percent of the time]. Because these events would occur for an hour or less, impacts would be limited to the immediate vicinity of the Long Wharf, and would be adverse, but less than significant (Class III).

<u>WQ-1: No mitigation is required.</u>

Impact WQ-2: Segregated Ballast Water

Discharge of ballast water that contains harmful microorganisms could impair several of the project area's beneficial uses, including commercial and sport fishing, estuarine habitat, fish migration, preservation of rare and endangered species, water contact recreation, non-contact water recreation, fish spawning, and wildlife habitat. Therefore discharge of segregated ballast water is determined to have a potentially significant impact to water quality (Class I).

Ballast water is used to provide stability to tankers and barges. Ballast water is taken to compensate for the lightering of vessels bringing crude oil or feed products to the Refinery. Segregated ballast water is kept in tanks that are segregated from oily cargo. Sometimes, however, ballast may be taken into cargo holds where it will come in contact with oil. Nonsegregated ballast water is considered a hazardous waste in California and cannot be discharged to Bay or coastal waters.

The only discharges from vessels associated with the Long Wharf to the receiving waters of the Bay are cooling water flow from ship systems and segregated ballast water. All other liquid wastes, including nonsegregated ballast water, cargo tank washwater, bilge water, and sanitary wastewater, are sent to the Refinery via numerous pipelines for treatment and ultimate discharge through the deep-water outfall to San Pablo Bay. The treatment and disposal of these wastewaters are discussed in the following section. Cooling water flow from ship systems includes flow from the main engines and auxiliary equipment operating during the time the ships are berthed at the Long Wharf. The volume of these cooling water flows is relatively small compared to the tidal flow past the Long Wharf. Therefore, the increase in water temperature of the Bay would be negligible and would not exceed limitations set forth in the California Thermal Plan.

Ballast water from segregated ballast tanks may be discharged from vessels to San Francisco Bay as vessels take on product from the Refinery or during transfer of product from a larger vessel to a smaller vessel or barge at Anchorage No. 9. Organisms in ballast water may have significant adverse impacts to biological resources and water quality. Impacts to biological resources are discussed in Section 4.3, Biological Resources. Release of segregated ballast water could have a significant adverse impact to water quality if viruses, toxic algae or other harmful microorganisms were released. Release of harmful microorganisms would violate the water quality objective for toxicity in the San Francisco Bay Basin Plan (RWQCB 1995). This objective states that waters be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms. Harmful algal blooms have been associated with such adverse effects as mass mortalities of pelicans and sea lions (attributed to the toxin domoic acid produced by the diatom *Pseudo-nitzchia australis*) off coastal California (Committee on Environment and Natural Resources 2000). Ballast water discharges have been implicated as one mechanism for the spread of harmful algae. In addition, ballast water may contain pathogens causing public health concerns (Falkner 2003).

California's Marine Invasive Species Act prohibits vessels entering California waters after operating outside the United States Exclusive Economic Zone (EEZ) from discharging ballast water into State waters unless the vessel has carried out a mid-ocean ballast water exchange procedure, or is using an environmentally sound alternative shipboard treatment technology approved by the CSLC. Beginning March 22, 2006, vessels operating within the Pacific Coast Region will be required to manage ballast water taken on within the Pacific Coast Region, by exchanging ballast water in near-coastal water before entering state waters, retaining all ballast water on board, using an approved, environmentally-sound treatment method, or discharging to an approved reception facility. Qualifying vessels must report the time and place ballast water was taken on and released during the voyage. Vessels docking at the Long Wharf comply with these requirements. (D. Kinkela, Chevron, pers. comm. 2005). Every ship entering State waters is required to submit a ballast exchange plan, including the co-ordinates of the location where ballast exchange takes place.

Mid-ocean exchange of ballast water is considered an interim measure to reduce the introduction of exotic species until effective treatment technologies are developed (Falkner 2003). Mid-ocean exchange reduces the introduction of exotic organisms but is not completely effective. One study of the ballast water of ships that had conducted mid-ocean exchange showed that ships that exchanged ballast water had 5 percent of the number of organisms and half the number of species compared to ships that did not exchange (Cohen 1998). Another study showed that 14 of 32 ships that conducted mid-ocean ballast exchange retained significant amounts of sediment and dinoflagellate cysts. Therefore, because mid-ocean exchange of ballast water is not completely effective, discharge of segregated ballast water is determined to have a potentially significant impact to water quality (Class I).

<u>Mitigation Measures for WQ-2</u>:

WQ-2. Chevron will advise agents representing vessels that have called at the Long Wharf as of the date of adoption of the cited Mitigation Monitoring Program, and Chevron will advise representatives of shipping companies having control over vessels that would be likely to call at the Long Wharf in the future about the California Marine Invasive Species Control Act. Chevron will ensure that a Questionnaire containing the following questions is provided to the Vessel Operator, and inform the Vessel Operator that the Questionnaire should be completed on behalf of the vessel, by its Captain or authorized representative, and provided to the California State Lands Commission's Marine Facilities Division's Northern California Field and Sacramento Offices, either electronically or by facsimile, prior to the vessel's entry into San Francisco Bay or in the alternative, at least 24 hours prior to the vessel's arrival at the Long Wharf.

Questionnaire shall solicit the following information:

1. Does the vessel intend to discharge ballast water in San Francisco Bay, the Carquinez Strait or any other location(s) in a Bay waterway on its transit to the Chevron Richmond Long Wharf?

2. Does the vessel intend to discharge ballast water at the Chevron Richmond Long Wharf?

3. Which of the following means specified in the California Marine Invasive Species Act (MISA) or Title 2, Division 3, Chapter 1, Article 4.6. has the vessel operator used or intend to use on the current voyage to manage the vessel's ballast water: a mid-ocean exchange (as defined in Section 71200(g)); a near-coastal exchange (as defined in Section 71201(b)); retain all ballast on board; or discharge the ballast water at the same location (as defined in Section 71204.2(c)(2)) where ballast originated, provided ballast water was not mixed with ballast water taken on in an area other than mid-ocean waters?

Rationale for Mitigation: Chevron has indicated that it is not feasible to treat segregated ballast water in the Refinery's effluent treatment system and that it would not be economically feasible to construct a system for treating ballast water to remove exotic species. Furthermore, effective systems for the treatment of ballast water to remove all associated organisms have not yet been developed. The measure provides an interim tracking mechanism until a feasible system to kill organisms in ballast water is developed. Until an effective treatment system is developed, the discharge of ballast water to San Francisco Bay will remain a significant adverse impact. Mid-ocean exchange reduces the introduction of exotic species but is not completely effective.

Residual Impacts: Until a feasible system to kill organisms in ballast water is developed, the discharge of ballast water to San Francisco Bay will remain a significant adverse impact (Class I).

Impact WQ-3: Cargo Tank Washwater, Bilge Water, and Sanitary Wastewater

Vessel wastes are treated and discharged in accordance with an NPDES permit and because the discharge is monitored and Chevron generally has been within permit requirements for the last five years, the impacts of chemical contaminants in treated terminal wastes on water quality are considered to be adverse, but less than significant (Class III).

Liquid wastes from vessels, including nonsegregated ballast water, cargo tank washwater, bilge water, and sanitary wastewater, are sent to the Refinery's effluent treatment system. The California Clean Coast Act (SB 771) prohibits the discharge of hazardous wastes, other wastes or oily bilgewater into California waters and also prohibits the discharge of graywater and sewage from vessels with sufficient holding tank capacity or from vessels capable of transferring wastewater to shoreside reception facilities. The California Clean Coast Act requires that all vessels visiting California in

2006 submit a report describing their capability to store graywater and sewage, and providing information on their marine sanitation devices to the CSLC. Wastewater treatment consists of biological treatment followed by granular activated carbon (GAC) filtration. Wastewater from the Refinery is ultimately discharged to San Pablo Bay through a deepwater outfall under NPDES Permit Number CA 0005014 issued by the SF-RWQCB. Nonsegregated ballast water on rare occasions may be received at the Long Wharf and transported to the Refinery for treatment. Non-segregated ballast water is discussed below under WQ-6. Table 4.2-12 shows the concentration and mass loading of contaminants from the Refinery discharge for each month in 1999. Copper sometimes exceeded criteria in the California Toxics Rule (EPA 2000) and nickel frequently exceeded criteria. Zinc exceeded California Toxics Rule criteria in September 1999. Although some contaminants exceeded criteria in the discharge, they would be rapidly diluted to concentrations below criteria in the receiving water. Organic contaminants are also monitored but less frequently. Dioxins, tributyltin, volatile compounds, organochlorine pesticides and PCBs were all below practical quantification levels when sampled in November 1999. PAHs (sampled quarterly) were below practical quantification levels on all but one sampling date. In April of 1999, the PAH concentration was 0.074 ug/l, well below Chevron's permit limit of 0.31 ug/l.

Chevron has had only 4 violations of their NPDES permit requirements for the wastewater outfall within the last 5 years (D. Kinkela, Chevron, Personal Communication, 2005). These included one exceedance of hexane extractable material (oil and grease), two exceedances of mercury and one of heptachlor epoxide. The exceedance for heptachlor epoxide was at the detection limit. The mercury exceedances were slight and represented exceedances of extra low detection limits that would have been undetectable using conventional mercury testing methods (D, Kinkela, Chevron, personal communication 2006). The RWQCB took no action in any of these instances. The Refinery does contribute various pollutants to the Bay including copper, mercury, selenium and nickel. Central San Francisco Bay is on the 303(d) list of impaired waterbodies for mercury, and selenium (SWRCB 2003). San Pablo Bay is on the 303(d) list for mercury, nickel, and selenium. Therefore, the Refinery does discharge measurable amounts of contaminants that are considered a problem for the area. However, the mass loadings of these contaminants from the Refinery outfall is very small compared to other sources. For example, the Refinery contributes about 197 kilograms (kg) of nickel per year to the Bay, approximately 0.4 percent of the estimated 49,000 kg contributed by stormwater runoff and 4 percent of the estimated emissions of 4,800 kg of nickel from the Bay Area point source dischargers (Davis et. al. 2000). It is not known how much of the pollutants discharged from the Refinery come from wastes received from the Long Wharf. However, because wastes from the Long Wharf generally comprise less than 2 percent of the wastes treated at the Refinery and discharged to the ocean, the contribution of Long Wharf wastes to the mass loading of contaminants in San Francisco Bay would be very small (for example: about 4 kg. per year of nickel). In addition, the Refinery accepts only Long Wharf wastes at intermittent intervals. Therefore, any elevations in contaminants related to Long Wharf wastes would occur for a brief period at the point of discharge. Furthermore, because these wastes are treated and discharged in accordance with an NPDES permit and because the discharge is monitored and, with occasional exceptions, Chevron has been within permit requirements for the last five years, the impacts of chemical contaminants in treated Long Wharf wastes on water quality are considered to be adverse, but less than significant (Class III).

Trash associated with terminal operations at the Long Wharf is collected by a contracted garbage disposal firm. Therefore, trash would not be discharged to Bay waters and would have no impact on water quality.

<u>WQ-3: No mitigation is required</u>.

Impact WQ-4: Discharges of Firefighting Water

Firewater has been treated at the Refinery and because contaminants in firewater would be diluted below thresholds within a matter of minutes, the impacts of firewater discharge on marine water quality are considered to be adverse, but less than significant (Class III).

Water for firefighting on the Long Wharf is treated wastewater from the Refinery that has undergone secondary (biological) treatment. This water may be discharged from the Long Wharf during tests of, or maintenance on, the fire protection system. Chevron estimates between 6,000 and 12,000 gallons a week are discharged during testing. These permitted discharges are conducted after monthly sampling to insure compliance with permit limits. Tests of this firewater at the Chevron Richmond Refinery showed that total suspended solids were 26 milligrams per liter (mg/l) with a Biochemical Oxygen Demand (BOD) of 4.5 mg/l and a Total Organic Constituents (TOC) of 116 mg/l. The only metals detected above the practical quantification level were arsenic, copper, nickel and selenium. Copper and nickel in the discharge were above the criteria in the California Toxics rule (EPA 2000). However, these metals would be rapidly diluted to below criteria in the receiving water. The estimated mass loadings of nickel were a maximum daily level of .0000039 kilograms. Therefore the average loading of nickel to the Bay would be about 0.01 kg per year. For copper and selenium, the total emissions per year would be 0.01 kg per year and 0.02 kg per year respectively. All organic contaminants with the exception of methyl chloride (21 ug/l) and bis(2-ethylhexyl)phthalate (20.8 ug/l) were below practical quantification levels. Because firewater has been treated at the Refinery and because contaminants in firewater would be diluted below thresholds within a matter of minutes, the impacts of firewater discharge on marine water quality are considered to be adverse, but less than significant (Class III). Testing of firewater systems is a necessary safety precaution at the Long Wharf.

<u>WQ-4: No mitigation is required.</u>

Table 4.2-12
Monthly Loading Summary for the Chevron Refinery Outfall for 1999

	Arsenic			Cadmium			Copper			Total Cyanide			Lead			Mercury			Silver		
	mg/l	lb/d	kg/d	mg/l	lb/d	kg/d	mg/l	lb/d	kg/d	mg/l	lb/d	kg/d	mg/l	lb/d	kg/d	mg/l	lb/d	kg/d	mg/l	lb/d	kg/d
January	0.013	0.60	0.27	<PQL	0.02	0.008	<PQL	0.14	0.06	<PQL	0.45	0.20	0.0044	0.196	0.09	<PQL	0.01	0.002	<PQL	0.05	0.020
February	0.015	0.63	0.29	<PQL	0.02	0.008	<PQL	0.14	0.06	<PQL	0.45	0.20	<PQL	0.18	0.08	<PQL	0.01	0.002	<PQL	0.05	0.020
March	0.013	1.07	0.48	<PQL	0.03	0.014	0.00	0.00	0.00	<PQL	0.79	0.36	<PQL	0.24	0.11	<PQL	0.01	0.004	<PQL	0.08	0.036
April	0.010	0.75	0.34	<PQL	0.03	0.013	<PQL	0.22	0.10	<PQL	0.72	0.33	<PQL	0.22	0.10	<PQL	0.01	0.004	<PQL	0.07	0.033
May	0.014	0.609	0.276	<PQL	0.03	0.013	0.0016	0.083	0.037	<PQL	0.43	0.195	0.004	0.186	0.084	<PQL	0.01	0.002	<PQL	0.04	0.019
June	0.012	0.387	0.176	<PQL	0.01	0.006	0.0095*	0.298	0.135	<PQL	0.32	0.14	<PQL	0.095	0.043	<PQL	0.004	0.002	<PQL	0.03	0.014
July	0.012	0.361	0.164	<PQL	0.01	0.006	<PQL	0.094	0.042	<PQL	0.31	0.14	<PQL	0.094	0.042	<PQL	0.004	0.002	<PQL	0.03	0.014
August	0.011	0.60	0.274	<PQL	0.02	0.010	<PQL	0.165	0.075	<PQL	0.55	0.25	<PQL	0.165	0.075	<PQL	0.007	0.003	<PQL	0.06	0.025
September	0.011	0.35	0.158	<PQL	0.01	0.006	<PQL	0.099	0.045	<PQL	0.33	0.15	<PQL	0.099	0.045	<PQL	0.004	0.002	<PQL	0.03	0.015
October	0.012	0.521	0.236	<PQL	0.02	0.008	0.0064*	0.274	0.124	<PQL	0.43	0.19	<PQL	0.128	0.058	<PQL	0.005	0.002	<PQL	0.04	0.019
November	0.010	0.639	0.290	<PQL	0.02	0.011	0.0079*	0.479	0.217	<PQL	0.61	0.28	<PQL	0.183	0.083	<PQL	0.007	0.003	<PQL	0.06	0.028
December	0.012	0.906	0.411	<PQL	0.03	0.013	0.0049*	0.358	0.162	<PQL	0.73	0.33	<PQL	0.220	0.100	<PQL	0.009	0.004	<PQL	0.07	0.033
Average	0.012	0.62	0.28	<PQL	0.021	0.010	0.0051*	0.19	0.09	<PQL	0.51	0.23	0.004	0.17	0.08	<PQL	0.006	0.0028	<PQL	0.051	0.023

* Exceeds criterion in California Toxics Rule.

Table 4.2-12 (Continued)
Monthly Loading Summary for the Chevron Refinery Outfall for 1999

	BOD			TOC			Selenium			Total Chromium			Hexavalent Chromium			Nickel			Zinc		
	mg/l	lb/d	kg/d	mg/l	lb/d	kg/d	mg/l	lb/d	kg/d	mg/l	lb/d	kg/d	mg/l	lb/d	kg/d	mg/l	lb/d	kg/d	mg/l	lb/d	kg/d
January	5.6	252.4	114.5	10.9	455.1	206.5	0.0397	1.04	0.472	<PQL	0.09	0.04	<PQL	0.45	0.20	0.024*	1.1	0.49	0.047	1.98	0.90
February	7.9	356.0	161.5	10.6	426.6	193.5	0.0171	1.05	0.476	<PQL	0.05	0.02	<PQL	0.45	0.20	<PQL	0.18	0.08	0.067	3.02	1.37
March	18.9	1490.5	676.1	11.9	957.0	434.1	0.0152	1.09	0.494	<PQL	0.08	0.04	<PQL	0.79	0.36	0.019*	1.46	0.66	<PQL	3.15	1.43
April	<PQL	434.10	196.9	12.2	905.6	410.8	0.0127	1.10	0.499	<PQL	0.07	0.03	<PQL	0.72	0.33	0.030*	2.20	1.00	0.027	1.95	0.89
May	22.70	973.7	441.7	16.4	715.4	324.5	0.0173	1.11	0.503	0.001	0.057	0.026	<PQL	0.43	0.19	0.043*	1.851	0.840	0.038	1.66	0.75
June	4.60	145.9	66.2	11.3	353.3	160.2	0.0186	1.10	0.499	0.001	0.033	0.015	<PQL	0.32	0.14	0.0340*	1.078	0.489	0.039	1.21	0.55
July	6.45	228.8	103.8	9.0	279.6	126.8	0.0201	1.10	0.499	0.0012	0.037	0.017	<PQL	0.31	0.14	0.0196*	0.612	0.277	0.050	1.55	0.70
August	3.61	199.1	90.3	10.8	607.9	275.7	0.0184	1.12	0.508	<PQL	0.055	0.025	<PQL	0.55	0.25	0.0383*	2.125	0.964	<PQL	5.52	2.50
September	4.40	179.2	81.3	5.3	161.9	73.4	0.0201	1.13	0.513	0.0013	0.043	0.019	<PQL	0.33	0.15	0.0234*	0.756	0.343	0.314*	10.36	4.70
October	4.60	195.8	88.8	8.7	168.9	76.6	0.0144	1.13	0.513	<PQL	0.043	0.019	<PQL	0.43	0.19	<PQL	0.170	0.08	<PQL	4.26	1.93
November	6.30	383.3	173.8	7.1	494.5	224.3	0.0109	1.08	0.490	0.001	0.063	0.028	<PQL	0.30	0.14	0.0258*	1.570	0.712	<PQL	6.08	2.76
December	14.80	1084.4	491.9	12.7	1013.1	459.5	0.0100	0.93	0.422	0.001472	0.104	0.047	<PQL	0.73	0.33	0.0167*	1.224	0.555	0.041	3.28	1.49
Average	9.08	493.6	223.9	10.6	544.9	247.2	0.018	1.08	0.491	0.001	0.06	0.03	<PQL	0.48	0.22	0.027*	1.19	0.54	0.078	3.67	1.66

* Exceeds criterion in California Toxics Rule.

Impact WQ-5: Non-Segregated Ballast Water

Non-segregated ballast water that is sent to the treatment facility may include nonindigenous organisms. Treatment at the facility does not include any specific procedures to prevent organisms that may be in ballast water from being discharged to Bay waters. Discharge of harmful microorganisms would be a significant adverse impact (Class II).

From January 1996 through August 1998, the Refinery received a total of about 200,000 gallons of nonsegregated ballast water for treatment on 9 different days (ranging from 7,900 to 55,300 gallons). The effluent treatment system has a daily average discharge of 7,500,000 gallons per day. Ballast water ranged from 0.12 to 1.68 percent of the daily flow during this 9-day period, which is within a 31-month period of ballast water receipt for which records are available. Therefore, the volume of ballast water from vessels is relatively small and infrequent, and receives treatment at the Refinery whose discharge is subject to a NPDES permit. Since December 1999, the Refinery has received no nonsegregated ballast water (D. Kinkela, Chevron, pers. comm. 2005). Chevron discourages the receipt of ballast water at its facility because the salt water is hinders operation of the effluent system. Starting in about 1997, the use of segregated ballast tanks on tankers became widespread, minimizing the need for on-shore treatment.

Non-segregated ballast water that is sent to the treatment facility may include nonindigenous organisms. Treatment at the facility does not include any specific procedures to prevent organisms that may be in ballast water from being discharged to Bay waters. Furthermore, the NPDES permit for the discharge does not include limitations on the discharge of organisms or requirements for monitoring of organisms. Filtration of process water at the Chevron facility would prevent the introduction of larger organisms. However, the potential exists for harmful microorganisms such as viruses, bacteria, and toxic algae to be discharged. Chevron indicates that it has not received non-segregated ballast water at its treatment facilities for several years (Kinkela, Chevron, pers. comm. 2005). Discharge of harmful microorganisms would be a significant adverse impact (Class II).

<u>Mitigation Measures for WQ-5</u>:

WQ-5. Chevron shall not discharge any non-segregated ballast water received at the Long Wharf to San Francisco Bay. If Chevron needs to unload unsegregated ballast water, it shall be unloaded into a tanker truck or other suitable wastehandling vehicle and disposed of at an appropriate facility.

Rationale for Mitigation: Handling of non-segregated ballast water at the Chevron Refinery apparently is a relatively rare event. Chevron indicated that it has not received any unsegregated ballast water at its facilities in the last several years. Therefore, transport of non-segregated ballast water to an appropriate disposal facility during the rare occasions when it is necessary to receive such water at the Long Wharf should be feasible.

Disposal of non-segregated ballast water at an approved facility will eliminate the potential introduction of harmful microorganisms that may be in this water. Impacts would be reduced to less than significant.

Impact WQ-6: Cathodic Protection

The slow leaching of zinc anodes may increase metal concentrations, but due to the slow rate of exchange of the anodes to seawater, the impact of cathodic protection on water quality is adverse, but less than significant (Class III).

Tankers and barges calling at the Long Wharf are made of steel and need cathodic protection. Many of these vessels have a coaltar-epoxy coating on their hull that insulates them from the saltwater. Tankers often use an impressed current system for cathodic protection. Barges typically use sacrificial zinc anodes for cathodic protection. The slow leaching of zinc anodes increases metal concentrations in the waters at the Long Wharf, but due to the slow rate of exchange of the anodes to seawater, it is thought to be negligible in comparison to ambient zinc in the marine environment. The impact of cathodic protection on water quality is adverse, but less than significant (Class III).

WQ-6: No mitigation is required.

Impact WQ-7: Anti-Fouling Paints

Marine anti-fouling paints are highly toxic containing copper, sodium, zinc, and tributyltin (TBT) and their use on vessels associated with the Long Wharf is considered to be a significant adverse impact to water quality that cannot be mitigated to less than significant (Class I).

Marine anti-fouling paints are used to reduce nuisance algal and marine growth on ships. These marine growths can significantly affect the drag of the vessel through the water and thus its fuel economy. Anti-fouling paints are biocides that contain copper, sodium, zinc, and TBT as the active ingredients. All of these are meant to be toxic to marine life that would settle or attach to the hull of ships. At a November 1997 session of the IMO Assembly in London, a resolution was approved that calls for the elimination of organotin biocides after 2003. The resolution language bans the application of tin biocides as anti-fouling agents on ships by January 1, 2003, and prohibits the presence of tin biocides after January 1, 2008. The Marine Environment Protection Committee of the IMO is developing a legal instrument to enforce the ban of TBT on vessels

(Lewis 2001). Much concern has been raised about TBT effects on non-target marine species. New types of bottom paints that do not contain metal-based biocides are being developed and tested. Some of these coatings, such as self-polishing coatings, are now in use. Because of the high toxicity of organotins to marine organisms, the use of these substances on vessels associated with the Long Wharf is considered to be a significant adverse impact to water quality that cannot be mitigated to less than significant (Class I).

Mitigation Measures for WQ-7:

WQ-7. Chevron will advise representatives of vessels that have called at the Long Wharf as of the date of adoption of the cited Mitigation Monitoring Program, and vessel representatives that would be likely to call at the Long Wharf in the future about the requirements of the 2008 International Maritime Organization (IMO) prohibition of TBT applications to vessel hulls. Following the effective date of the IMO prohibition, Chevron will ensure that the Master (Captain) or authorized representative of vessels intending to call at the Long Wharf certify that their vessel is in compliance and provide a copy of such certification to the California State Lands Commission's Marine Facilities Division's Northern California Field and Sacramento Offices, either electronically or by facsimile, prior to the vessel's entry into San Francisco Bay or in the alternative, at least 24 hours prior to the vessel's arrival at the Long Wharf.

Rationale for Mitigation: Until all TBT is phased out by 2008, vessels with old applications of TBT on their hulls will visit the Long Wharf. Although it is reasonable for Chevron to require vessels to document no new TBT applications (per IMO mandate), Chevron cannot feasibly require vessels to remove TBT from their hulls until the IMO mandate prohibiting the presence of TBT on ship hulls comes into effect in 2008. Therefore, until all TBT is gone from vessels using the Long Wharf, impacts of organotins will remain significant. Prior to the effective date of the IMO mandate, the mitigation measure has Chevron advise agents of shipping companies about the future requirements; after the effective date of the IMO mandate, Chevron will certify that visiting vessels are in compliance and submit copies to CSLC. This will help to reduce impact to water quality by eliminating organotins, and also eliminate toxicity to marine organisms.

Residual Impact: Until all TBT is gone from vessels using the Long Wharf, impacts of organotins will remain significant (Class I).

Impact WQ-8: Tanker Maintenance

Routine vessel maintenance would have the potential to degrade water quality due to chronic spills during transfers of lubricating oils, resulting in adverse significant (Class II) impacts.

Minor repair and routine maintenance of vessels occur at the Long Wharf. Most of these repairs have little effect on water quality. Vessels may take on lubricating oils from trucks at the Long Wharf, which have a potential to spill into the water. All transfer areas (i.e., work areas around risers, loading arms, hydraulic systems etc.) are protected by berms and drain to sumps that operate on level control and transfer their liquid to the Refinery waste handling systems for treatment. The impact of chronic spills is adverse and significant (Class II).

Mitigation Measures for WQ-8:

WQ-8. MM WQ-9 applies which addresses preparation of Best Management Practices (BMPs) in a SWPPP for the Long Wharf.

Rationale for Mitigation: Aggressive implementation of BMPs to reduce the input of chemicals to the Bay from operations on the Long Wharf would reduce Chevron's input of these chemicals to adverse but less than significant.

Impact WQ-9: Stormwater Runoff from the Wharf

Stormwater runoff from the Long Wharf may contribute pollutants to the Bay in concentrations that may adversely affect some benthic species within the local area, resulting in a significant adverse impact (Class II) to water quality.

Stormwater runoff is the largest contributor of pollutants to San Francisco Bay (Davis et. al. 2000). Hydrocarbons and other contaminants that accumulate on surfaces of the Long Wharf will runoff to the ocean during storms. As described in Section 2.3.3, Operational Procedures, Operational Procedures, Chevron has several Best Management Practices (BMPs) in place to prevent the spill of oily liquids during transfer operations. The transfer area of each berth is impounded by a raised berm. Drip pans are located under all piping manifolds at the berth areas and are designed to collect drips from bolted flanges, fittings and expansion joints. Collected oil and water are drained to sumps along the inside face of the Long Wharf and pumped to oil tanks at the Refinery. Chevron employs vacuum trucks to empty drip pans that do not drain to sumps. However, there is the potential for contaminants to accumulate on the Long Wharf surface from routine vehicle use, maintenance activities and other operations. For example oil spills reported by Chevron include a couple of small spills of hydraulic fluid during maintenance or testing of hydraulic hoses. Most of the spilled hydraulic oil was contained on the dock. However, some oily residue may have remained on the dock and been washed off during the next storm. Oily residue is the contaminant most likely to be present in runoff from the Long Wharf. Although Chevron has a number of BMPs in place at the Long Wharf, it has no formal stormwater management plan for the Long Wharf.

Concentrations of a number of contaminants under the Long Wharf are at levels that exceed the ER-L indicating that there may be some adverse biological effects on species sensitive to contaminants (Tables 4.2-5 and 4.2-6). With a few exceptions, contaminant concentrations under the Long Wharf were within the Ambient Sediment Concentration thresholds for relatively unpolluted areas of San Francisco Bay (Gandesbery et al. 1999). Therefore, contamination from the Long Wharf does not appear to be creating a toxic "hot spot" with highly elevated sediment contaminant concentrations compared to other areas of the Bay. Some PAH compounds and some metals episodically exceed Ambient Sediment Concentration thresholds perhaps indicating occasional small leaks or spills. Because contaminant levels in the vicinity of the Long Wharf exceed criteria, inputs from runoff from the Long Wharf are considered to have a significant adverse impact to water quality that may be mitigated to less than significant (Class II).

Mitigation Measures for WQ-9:

WQ-9. Implement BMPs to reduce the input of chemicals to the Bay from the marine terminal, including (at a minimum) (1) conducting all vehicle maintenance on land not over water or marshland, (2) berming all areas on the pier where maintenance activities are being conducted and cleaning up all spilled contaminants before berms are removed, (3) washing the surface of the pier to the extent practical and directing washwater into sumps, (4) maintenance of sumps, and (5) posting signs to educate all workers to the importance of keeping contaminants from entering the Bay. These BMPs shall be detailed in a Stormwater Pollution Prevention Plan that Chevron shall prepare specifically for the Long Wharf.

Rationale for Mitigation: No Stormwater Pollution Prevention Plan (SWPPP) presently exists for the Long Wharf. The requirement to include measures specific to Long Wharf Operations in the Chevron SWPPP and the implementation of those measures will help reduce the input of contaminants into the Bay from operations on the Long Wharf. Aggressive implementation of BMPs to reduce the input of chemicals to the Bay from stormwater runoff would reduce Chevron's input of these chemicals to adverse but less than significant.

Impact WQ-10: Maintenance Dredging

The effects of dredging and dredged material disposal on water quality are regulated and subject to acquisition of a dredging permit prior to dredging, thus impacts on water quality are adverse, but less than significant (Class III).

With the proposed Project, Chevron would continue maintenance dredging to maintain water depths necessary for safe approach and berthing of vessels at the Long Wharf. The estimated maintenance dredging moves up to approximately 350,000 cubic yards per year. In the past, the dredged sediments were disposed of at the Alcatraz disposal site (SF-11). Future dredged sediment disposal would be in accordance with the Long Term Management Strategy for Placement of Dredged Material in the San Francisco Bay Region (USACE, USEPA, BCDC, SFBRWQCB 2001).

Sediments at the Long Wharf are sampled and analyzed approximately every 2 to 3 years to provide information to support application for Chevron's maintenance dredging permit. Sediments at the Long Wharf are composed primarily of silt and clay sized particles (Table 4.2-5 and 4.2-6). As discussed above, the concentrations of several contaminants exceeded the ER-L concentration in some samples, but only nickel exceeded the ER-M concentration. In general, contaminant concentrations were below the Ambient Sediment Concentration thresholds for San Francisco Bay. Although nickel was above the ER-M in the majority of the Long Wharf sediment samples, it exceeded the Ambient Sediment Concentration threshold on only one occasion. Nickel is naturally high in soils and rock in the San Francisco Bay area (San Francisco Estuary Institute 2002). Toxicity tests have indicated that sediments from the Long Wharf have relatively low toxicity to marine organisms.

Dredging and disposal of sediments from the Long Wharf may have an adverse effect on water clarity. Because of the fine grain size of the material, it requires more time to settle to the bottom than larger grain-size sands. If there are swift currents at the disposal site (such as at the Alcatraz site), the turbid plume of material suspended in the water column may extend to a large area of San Francisco Bay. Sediments dredged will be anaerobic and may have an effect on dissolved oxygen concentrations of the water column in the disposal area. These effects generally occur for a brief period of time (Chambers Group 1998). Resuspension of dredged sediments is not expected to expose marine organisms to toxic concentrations of contaminants, because of the low toxicity of Long Wharf sediments. Monitoring of water column chemicals during dredging projects in San Francisco Bay indicated that contaminant concentrations did not exceed water quality objectives (Corps and Contra Costa County 1997).

Dredged material disposal in San Francisco Bay are regulated by the interagency Dredged Materials Management Office (DMMO). This interagency group evaluates the physical and chemical characteristics of the dredged sediments to make sure that they are compatible for in-water disposal in the Bay. Because the effects of dredging and dredged material disposal on water quality are transitory and because sediment composition is evaluated by the DMMO before a dredging permit is issued, the impacts of maintenance dredging at the Long Wharf on water quality are determined to be adverse but less than significant (Class III). The impacts to water quality of expansion of Berth No. 4 would be similar to the impacts of maintenance dredging. Impacts would result in temporary suspension of sediment and would be adverse, but less than significant (Class III).

<u>WQ-10: No mitigation is required</u>.

Impact WQ-11: Oil and Product Leaks and Spills at the Long Wharf

Potential impacts on water quality can result from leaks or spills. Small leaks or spills (less than 50 bbl) related to Long Wharf operations could result in significant (Class II) impacts, while large spills (greater than 50 bbl) could result in significant adverse impacts (Class I).

Fate and Behavior of Petroleum Hydrocarbons Spilled in the Marine Environment

To accurately assess the impacts of petroleum spills and chronic discharges to the marine environment, it is necessary to know the make up of the crude oil or product spilled and the physical, chemical, and biological processes that transform petroleum hydrocarbons spilled in the in the marine environment. Several comprehensive reviews describe the fate and behavior of petroleum introduced into the marine environment (NRC 1985, 2003; Jordan and Payne 1985; Hayes, Michel, and Montell 1993; Rytkonen, Hirvi, and Hakala 1991).

A wide range of crude oil, feed stocks, additives, and processed petroleum products are transferred through the Long Wharf between the Refinery and ships. The Long Wharf typically receives about 98 million bbls of crude oil, diesel fuel oil, gasoline components, diesel blend stock, and dirty diesel/flush stock annually. Of this amount, approximately 80 million bbls per year are crude oil of both domestic and foreign origin. The Long Wharf typically ships approximately 35 million bbls annually of gasoline, gasoline components, aviation fuel, jet fuel, diesel fuel, and lubricating oils.

Crude oils vary widely in appearance and viscosity from field to field. Within the same field, the properties of crude oil vary greatly depending on the season and other environmental factors when the oil was extracted (Chambers Group 1994, NRC 2003). Crude oil and petroleum products are complex substances. Crude oil typically is a mixture of several hundred distinct compounds, most of them hydrocarbons, containing hydrogen and carbon in various proportions. Of the hydrocarbon compounds common in petroleum, polycyclic aromatic hydrocarbons (PAH) appear to pose the greatest toxicity to the environment (NRC 2003). When crude oil is distilled into petroleum products, it is essentially sorted into fractions by the boiling temperature of these hundreds of compounds. Boiling temperature is strongly correlated with the number of carbon atoms in each molecule. Therefore, some petroleum products have low boiling temperatures and relatively simple molecules with few carbon atoms, while others have higher boiling temperatures, larger molecules, and more carbon atoms per molecule. The higher the boiling temperature, the greater the density of the resulting product.

Refiners control the mix of hydrocarbon types in particular products in order to give petroleum products distinct properties. Hydrocarbons in the C2-C4 range are all natural gas liquids; hydrocarbons in the C5-C10 range predominate in naphtha and gasoline; and C12-C20 comprises middle distillates, which are used to make diesel fuel, kerosene, and jet fuel. Larger molecules generally wind up as lubricants, waxes, and residual fuel oil. Each of the hydrocarbons has distinctive characteristics and differs in density, vapor pressure, and solubility. Therefore, the fate of spilled oil in water varies significantly depending on the make up of the oil spilled.

The fate of spilled oil in the marine environment is determined by a variety of complex and interrelated physical, chemical, and biological transformations. The physical and chemical processes involved in the "weathering" process of spilled oil include evaporation, dissolution and vertical mixing, photochemical oxidation, emulsification, and sedimentation (NRC 2003). The rate of these weathering processes is influenced by a variety of abiotic factors (e.g., water temperature, suspended particulates, water clarity), physical-chemical properties inherent to the oil itself (e.g., vapor pressure, solubility, aromatic, asphaltene, and wax content), and the relative composition of the hydrocarbon source matrix (e.g., crude oil or refined products). The mass fraction of aromatic present in a crude oil is an important indicator of potential toxicity of a spill, because aromatics are considered the most toxic hydrocarbons in oil (Galt et al. 1991). The asphaltene and wax content determines water-in-oil emulsion formation and is an indicator of how well crude oil will form a stable emulsion or mousse in seawater.

The biological processes involved in the weathering of spilled oil include microbial degradation and uptake of hydrocarbons by larger organisms and its subsequent metabolism. The biodegradation of petroleum by microorganisms is one of the principal mechanisms for removal of petroleum from the marine environment. Enhancement of natural biodegradation processes by microbes may be one of the least ecologically damaging ways of removing oil from the marine environment. Uptake of hydrocarbons by large organisms usually has adverse impacts in the biota because of the toxicity of petroleum hydrocarbons.

Several competing forces occur simultaneously once oil has been released into the marine environment. The processes affecting the fate of spilled oil include (1) advection (drift) and spreading, (2) evaporation, (3) dissolution, (4) dispersion, (5) emulsification, (6) photooxidation/autooxidation, and (7) sedimentation. Advection or drift is measured by the movement of the center of mass of an oil slick and is primarily controlled by wind, waves, and surface currents. Spreading of oil on water is probably the most significant process for the first 6 to 10 hours following a spill. Gravitational, inertial, and frictional forces are responsible for spreading oil. As spreading occurs, the volatile fractions of the oil are lost to evaporation or dissolution, leading to an increase in the viscosity and specific gravity of the remaining oil. Depending on the product spilled, the rate of evaporation can be important in determining if impacts occur. Spills of refined products, such as kerosene, gasoline, aviation fuel, and jet fuel, may completely evaporate within 24 hours of the spill. Evaporation can account for up to 50 percent of a crude oil spill being lost during the first 24 to 48 hours. Evaporation depends on the physical properties of the spilled oil and on sea state, intensity of solar radiation, wind velocity, and air and sea temperatures.

Because of the low aqueous solubility of most hydrocarbon components of crude oil, dissolution is less important than evaporation. Salinity, temperature, and turbulence of seawater affect the dissolution rate of each hydrocarbon component. The more soluble petroleum hydrocarbons are those with the greatest aromatic and olefin characteristics. For example, the toxic polynuclear aromatics are more soluble in seawater than the relatively nontoxic, longer chain paraffins.

The movement of small particles, or globules, of oil into the water column (dispersion) is believed to be caused by propulsion of surface turbulence (wind, waves, and ship traffic). Such oil-in-water emulsions are unstable and can be stabilized only by natural or added emulsifiers, detergents, dispersants, or suspended particulates. Generally, an oil spill will begin to disperse immediately, and, after 100 hours, dispersion will overtake spreading as the principal mechanism for distributing spilled oil (SAIC 1984).

Emulsification arises from the dispersion of spilled oil and represents a change of state from an oil-in-water dispersion to a water-in-oil emulsion. Crude oils with high asphaltene content, or high viscosity, form mousse emulsions more than paraffin crude oils (Bocar and Gatellier 1981, cited in NRC 1985). Lighter petroleum distillates, such as gasoline, kerosene, aviation fuel, jet fuel, and diesel fuel oils, do not form mousse (NRC 1985).

Photooxidation (the action of sunlight in the presence of oxygen) is a long-term weathering process, which can degrade toxic components in petroleum. For example, potential carcinogens such as benzo[a]pyrene have been shown to be photooxidized by sunlight. Oil that evaporates is photochemically oxidized in the atmosphere. In surface water, photooxidation may be important on a time scale of minutes to days.

Sedimentation and sinking of spilled oil is caused by sorption on particulates and ingestion of hydrocarbons by zooplankton. Weathering processes increase the density of oil, which leads to incorporation of particulates and the agglomeration of oil-particulate mixtures that eventually sink. In general, extensive weathering is required before the oil residual has a specific gravity greater than that of seawater. Some weathering and fractionation of oil appears to be necessary before incorporation into suspended material. Test tank studies have show that fractionation of oil is common before it is incorporated into suspended particulate material.

Impacts of Spilled Oil in the Water

A significant impact to marine water quality (Class I or II impact) would result from changes in water chemistry from an accidental spill of crude oil or oil product in either San Francisco Bay (at the Long Wharf or along tanker routes) or outer coast waters. Spill probabilities are presented in Section 4.1, Operational Safety/Risk of Accidents. Long Wharf operations have the greatest potential for small spills (less than 50 bbl), while the larger spills would more typically result from ships in transit. The containment and cleanup capability at the Long Wharf is detailed in Section 4.1, Operational Safety/Risk of Accidents, Impact OS-3.

Physical properties affected by an oil spill include reduced wind stress and thus reduced water surface mixing which limits the exchange of dissolve oxygen between the water and the atmosphere, reduced light transmissivity, and reduced solar warming of the sea surface. The total sea surface area affected by a spill depends on the volume of oil released and the prevailing meteorological conditions, particularly winds.

Most small leaks or spills (less than 50 bbl) related to operation of the Long Wharf could result in significant, adverse (Class II) impacts that can be mitigated to less than significant, because they could be easily contained. However, the severity of impact from larger leaks or spills (greater than 50 bbl) at the Long Wharf depends on (1) spill size, (2) oil composition, (3) spill characteristics (instantaneous vs. prolonged discharge), (4) the effect of environmental conditions on spill properties due to weathering, and (5) the effectiveness of cleanup operations. In the event of an oil spill, the initial impacts would be to the quality of surface waters and the water column, followed by potential impacts to sedimentary and shoreline environments. Following an oil spill, hydrocarbon fractions would be partitioned into different regimes and each fraction would have a potential impact on water quality. Large spills (greater than 50 bbl) at the Long Wharf could result in significant, adverse (Class I) impacts on water quality.

Most tanker spills/accidents and larger spills that cannot be quickly contained either in the Bay or along the outer coast would result in significant, adverse (Class I) impacts.

The duration of potential impacts to water quality is variable and depends on the type of oil spilled. The most toxic period for crude oil spilled is the first few days due to volatile, low molecular weight hydrocarbons (BLM 1979). Product spills of gasoline and fuels may evaporate faster than crude oil, but are generally more toxic and more soluble. Toxicity tests performed on oil by the EPA have shown that aromatic constituents are the most toxic, naphthenes and olefins are intermediate in toxicity, and straight chain paraffins are the least toxic (Chambers Group 1988).

<u>Mitigation Measures for WQ-11</u>:

WQ-11. MM OS-3a through MM OS-3d (Operational Safety/Risk of Upset) and MM OS-4 shall be implemented.

<u>Rationale for Mitigation</u>: These measures provide greater safety in preventing spills and improving response capability and help to reduce impacts to water quality to the maximum extent feasible. Small leaks or spills resulting from Long Wharf operations that can be easily contained would result in adverse but less than significant impacts.

<u>Residual Impacts</u>: Large spills at the Long Wharf (greater than 50 bbls) may result in significant adverse impacts (Class I) on water quality.

4.2.4.2 Oil Spills from Vessels in Transit in Bay or along Outer Coast

Impact WQ-12: Water Quality Impacts from Accidental Spills

A significant impact to water quality (Class I or II) could result from leaks or an accidental spill of crude oil or oil product from a vessel spill along tanker routes either in San Francisco Bay or outer coast waters.

The fate and water quality impacts of oil from a spill associated with vessels servicing the Long Wharf would be similar to the impacts described above for a spill at the Long Wharf. A significant impact to water quality (Class I or II) would result from an accidental spill of crude oil or oil product from a vessel transiting San Francisco Bay or outer coast waters. A larger oil spill is more likely from accidents associated with vessels in transit than a spill at the Long Wharf. Most tanker spills/accidents and larger spills that cannot be quickly contained either in the Bay or along the outer coast would result in significant, adverse impacts (Class I).

Mitigation Measures for WQ-12:

WQ-12. The Long Wharf shall implement MM OS-7a and OS-7b of Section 4.1, Operational Safety/Risk of Upset Section, addressing potential participation in VTS upgrade evaluations, and Chevron response actions for spills at or near the Long Wharf.

Rationale for Mitigation: A spill from a tanker is the responsibility of the vessel owner/operator. Each vessel is required to have an oil spill contingency plan that identifies response measures for containment, recovery, and protection of sensitive resources. The Long Wharf operator is much more suited to provide immediate response to a spill using equipment and resources located at or near the Long Wharf. In addition, the Long Wharf staff is fully trained to take immediate actions in response to spills at or near the Long Wharf. The vessel would have to contact its response organization, which may take some time to mobilize. Therefore, Chevron shall agree to respond to the spill as if it were its own until such time as the vessel's response organization can take over management of the response actions in a coordinated manner.

Residual Impacts: Even with these measures, the residual impacts to water quality may remain significant (Class I).

4.2.5 Impacts of Alternatives

WQ-13: No Project Alternative

The alternative would eliminate the water quality impacts associated with operations at the Long Wharf resulting in a beneficial (Class IV) impact. Water quality impacts from spills (Class I, II and III) would be transferred to other marine terminals and would be similar to the proposed Project. Chevron has no responsibility for these other terminals. Decommissioning and removal of the Long Wharf might result in temporary, adverse, but less than significant impacts on water quality (Class III).

Under the No Project Alternative, Chevron's lease would not be renewed and the existing Long Wharf would be subsequently decommissioned with its components abandoned in place, removed, or a combination thereof. The decommissioning of the Long Wharf would follow an Abandonment and Restoration Plan as described in Section 3.3.1, No Project Alternative.

Under the No Project Alternative, alternative means of crude oil/product transportation would need to be in place prior to decommissioning of the Long Wharf, or the operation of the Chevron Refinery would cease production, at least temporarily. It is more likely, however, that under the No Project Alternative, Chevron would pursue alternative means of traditional crude oil transportation, such as a pipeline transportation, or use of a different marine terminal. Accordingly, this EIR describes and analyzes the potential environmental impacts of these alternatives. For the purposes of this EIR, it has been assumed that the No Project Alternative would result in a decommissioning schedule that would consider implementation of one of the described transportation alternatives. Any future crude oil or product transportation alternative would be the subject of a subsequent application to the CSLC and other agencies having jurisdiction, depending on the proposed alternative.

During decommissioning, impacts would be similar to the proposed Project with the potential for small spills associated with pipeline drainage, pipeline and pier removal. Also, removal of the Long Wharf pier could result in temporary impacts to water quality from sediment disturbance. These impacts would be short lived and are considered adverse but less than significant (Class III).

Following decommissioning, no impacts would be associated with the Long Wharf because there would be no operations. The potential impacts of spills on water quality would remain similar to the proposed Project, but would be transferred to another marine terminal. The transfer of tanker traffic from the Long Wharf to another marine terminal would eliminate inputs of contaminants from runoff from the Long Wharf as well as some of the small leaks and spills that enter the water directly from Long Wharf operations. This alternative also would eliminate the discharge of treated firewater from the Long Wharf. Because the additional tanker traffic at another marine terminal would not be expected to increase significantly the quantity of contaminants in stormwater runoff or firewater discharge from the other terminal, this alternative would have fewer impacts to water quality than continued terminal operations at the Long Wharf.

The No Project Alternative would eliminate the temporary water quality impacts associated with maintenance dredging to maintain adequate depth at the berth. Because the additional tanker traffic at another marine terminal would not be expected to increase significantly maintenance dredging, this alternative would have fewer impacts to water quality than continued terminal operations at the Long Wharf.

Water quality impacts associated with vessels would be transferred to another marine terminal and would be similar to the proposed Project. These impacts include turbidity generated by boat propellers and bow thrusters, introduction of exotic organisms in ballast water discharges, discharge of heated cooling water, introduction of toxins used as anti-fouling agents on tankers, and introduction of metals from cathodic protection on vessels. These potential impacts of spills on water quality would remain similar to the proposed Project, but would be transferred to another marine terminal.

<u>WQ-13: No mitigation is required</u>.

WQ-14: Full Throughput via Pipeline Alternative

Reduced quantities of crude and product would be handled at another terminal in the Bay Area, and transferred to the Refinery via pipeline. In the event of a pipeline break and spill, there is the potential that water quality could be compromised if the spill would reach a creek, stream, lake, or other water body. This could result in a significant, adverse (Class I or II) impact depending on whether the spill could be contained easily and whether other resources such as habitats may be affected.

With this alternative, reduced quantities of crude and product would be handled at another terminal in the Bay Area, and transferred to the Refinery via pipeline. The remainder of crude and product from other sources would also be transferred via pipeline. The impacts to water quality associated with Long Wharf operations, vessels in transit, and spills would be similar to that presented for the proposed Project but could increase risk at another terminal. In the event of a pipeline break and spill, there is the potential that water quality could be compromised if the spill would reach a creek, stream, lake, or other water body. This could result in a significant, adverse (Class I or II) impact depending on whether the spill could be contained easily and whether other resources such as habitats may be affected. Spills from these other terminals could result in a significant, adverse impacts depending on whether the spill could be contained easily and whether a water body is affected.

Although a significant impact to water quality can occur from a pipeline leak or spill, it is less likely to have significant water quality impacts than a spill associated with tanker operations. In many cases, pipeline leaks or spills may be contained and cleaned up before Bay waters were contaminated. Although the consequences of a spill at another marine terminal would likely be similar to those of a spill at the Long Wharf, the fact that the total number of tankers would be reduced would also reduce the overall probability of a spill related to tanker traffic.

<u>Mitigation Measures for WQ-14</u>:

WQ-14. Implement MM GEO-8 for mitigation for land-based spills. Mitigation shall include adherence to spill prevention and response planning for the geographical area, and pipeline engineering and design based on detailed analysis conducted for the selected alignment(s).

<u>Rationale for Mitigation</u>: The measures are standard practice for on-land spill cleanup and may have specific provisions that vary by geographical area to respond to specific resources. If Chevron could not use the Long Wharf and was required to construct additional pipelines or other facilities, they would have to follow the CEQA process, which would most likely require the mitigation measures to reduce system safety impacts.

<u>Residual Impact</u>: Significant adverse impacts to water quality could still occur if significant amounts of oil reached a waterbody.

Impact WQ-15: Conceptual Consolidation Terminal Alternative

The Consolidation Terminal would share tankering operations, in addition to requiring new pipelines for transfer of crude and product to the Refinery. Construction and operation of new pipelines have potential for impacts on water quality that may be Class I or Class II.

The transfer of some of the tanker traffic from the Long Wharf to another terminal would be unlikely to reduce the input of contaminants from routine operations at the Long Wharf. Treated firewater would still be discharged periodically. Contaminants would accumulate on the surface of the Long Wharf to be washed into the Bay during storms. Maintenance dredging would still be required to maintain adequate depth for tankers. Transfer of Long Wharf tanker traffic to another terminal would not be expected to increase significantly contaminant input from stormwater runoff or firewater discharge from the other terminal. Therefore, this alternative would have similar impacts to marine water quality as the proposed Project.

With this alternative, the potential impacts of spills on water quality would remain similar to the proposed Project, but would be shared with another marine terminal (Class I and II). Because pipelines would connect the Consolidation Terminal with the Chevron Refinery, there would also be the potential consequences associated with a pipeline spill as discussed above. Pipeline spills are less likely to have significant water quality impacts than spills associated with tankers because they are more likely to be contained before they reach the water.

Mitigation Measures for WQ-15:

WQ-15. Implementation of MM WQ-14, include MM OS-3a-d, MM OS-4 and MM GEO-8 apply for mitigation for land-based spills shall include adherence to spill prevention and response planning for the geographical area, and pipeline engineering and design.

Rationale for Mitigation: MM WQ-14, MM OS-3a-d and MM OS-4 all provide for protection against spills. MM GEO-8 measures are standard practice for on-land spill cleanup and may have specific provisions that vary by geographical area to respond to specific resources. If Chevron could not use the Long Wharf and was required to construct additional pipelines or other facilities, they would have to follow the CEQA process, which would most likely require the mitigation measures to reduce system safety impacts.

Residual Impacts: Significant adverse water quality impacts (Class I) could occur if significant amounts of oil reached a waterbody.

4.2.6 Cumulative Projects Impacts Analysis

Impact CUM-WQ-1: Contaminants Impacts on Bay and Outer Coast Water Quality

The water quality of the San Francisco Bay estuary has been degraded by inputs of pollutants from a variety of sources, as such, any contribution of a contaminant already at significantly high levels to the waters of San Francisco Bay would have a significant adverse impact at the cumulative level (Class I). Chevron would not contribute significantly to Outer Coast impacts to water quality (Class III).

The water quality of the San Francisco Bay estuary has been degraded by inputs of pollutants from a variety of sources. Major sources of contaminants include municipal wastewater and industrial discharges and a variety of nonpoint sources such as urban and agricultural run-off; riverine inputs; dredging and dredge material disposal; marine vessel inputs; and inputs from air pollutants, spills, and accidents. In general, storm water run-off is responsible for the greatest mass loadings of most contaminants (Davis et al. 2000). The sources of contaminants to the San Francisco Bay estuary and the levels of contaminants throughout the estuary are discussed in detail in Section 4.2.1, Environmental Setting. That section describes levels of many contaminants in the water column, in the sediments, and in the biota in the estuary that either exceed water quality objectives in the San Francisco Bay Basin Plan or are at levels known to have harmful effects on aquatic organisms. Table 4.2-13 lists contaminants of particular concern in the San Francisco estuary.

Any contribution of a contaminant already at significantly high levels to the waters of San Francisco Bay would have a significant impact at the cumulative level (Class I). Of the contaminants listed as significantly elevated in Table 4.2-13, operations at the Long Wharf would not contribute to pesticides. Chevron tankers may have contributed to TBT contamination in the past, but the application of TBT on tankers is being phased out. Because organotins are so toxic to marine organisms, any continued use of organotins by vessels in San Francisco Bay is a significant adverse cumulative impact.

The mass emissions of several pollutants from Chevron's discharges were compared to other sources in Section 4.2.1, Environmental Setting, above. The contribution of Chevron's Refinery to the mass emissions of nickel (a 303 [d] list pollutant in San Pablo Bay) in San Francisco Bay was approximately 0.4 percent the estimated mass loading of nickel to the Bay from stormwater and approximately 4 percent that of major permitted discharges. If the Long Wharf contributes 1 to 2 percent of the nickel in the Refinery discharge, mass loading of nickel from the Refinery would contribute approximately 2 to 3.8 kg. of nickel per year or less than .01 percent of the nickel loading from stormwater and less than 0.1 percent of the loading from permitted dischargers. Mass emissions of nickel, copper and selenium from firewater discharges used for hydrostatic testing and other purposes at the Long Wharf were all estimated to contribute less than .02 kg per year of these metals of concern.

Table 4.2-13
Pollutants of Particular Concern in the Bay/Delta Estuary

TRACE ELEMENTS	
Cadmium	Selenium
Copper	Silver
Mercury	Tin (Tributyl)
Nickel	
ORGANOCHLORINES AND OTHER PESTICIDES	
Chlordane and its metabolites	Polychlorinated biphenyls
DDT and its metabolites	Toxaphene
PETROLEUM HYDROCARBONS	
POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs)	
Acenaphthene	2, 6-Dimethylnaphthalene
Acenaphthylene	Fluoranthene
Anthracene	Fluorene
Benz(b)fluoranthene	1-Methylnaphthalene
Benz(k)fluoranthene	2-Methylnaphthalene
Benz(g, h, i)perylene	1-Methylphenanthrene
Benzo(a)pyrene	2-(4-morpholinyl)benzthiazole
Benzo(e)pyrene	Naphthalene
Benzo(a)anthracene	Phenanthrene
Benzthiazole	Pyrene
Chrysene	2, 3, 5-Trimethylphenanthrene
Dibenzo(a, h)anthracene	Indeno(1, 2, 3-c,d)pyrene
Source: Monroe and Kelly 1992.	

Of the other contaminants, operations at the Long Wharf would contribute small quantities of metals and PAHs. Inputs from the Long Wharf include segregated ballast waters, small leaks and spills of oil and product, some contaminants in vessel paint or sacrificial anodes, and a portion (about 1 percent) of the discharge from the Refinery. Of those sources, only the Refinery discharge is quantified. The Refinery's discharge of 7 to 8 mgd is approximately 1.5 percent of major permitted discharges in the San Francisco estuary (Table 4.2-1). Based on an average contribution to the Refinery of about 1 percent of the total Refinery discharge, the percentage of permitted discharges to the Bay contributed by the Long Wharf would be about 0.002 percent. Table 4.2-1 shows that the Bay's largest municipal discharger, the San Jose/Santa Clara Water Treatment Plant (WTP) located in the South Bay, discharges 133 mgd of treated municipal sewage. Furthermore, inputs from nonpoint sources, including the San Joaquin and Sacramento Rivers and urban runoff, far exceed the permitted point source discharges, especially in wet years. Therefore, the contribution to total contaminant loads in the San Francisco estuary from treated wastewater from the Long Wharf is very small.

Emissions of contaminants from stormwater runoff from the Long Wharf are unknown. Because of the small size of the Long Wharf compared to the watersheds that contribute runoff to the Bay, the total stormwater emissions from the Long Wharf would be expected to be relatively small compared to the total emissions in all stormwater runoff to the Bay. However, the Long Wharf is a paved surface on which industrial activities occur and therefore storm runoff may contribute fairly high concentrations of contaminants even though the volume of runoff would be expected to be relatively low.

Similarly, the amount of material released from chronic releases at the Long Wharf is generally small. Table 4.1-1 lists the history of spills at the Long Wharf since 1992. During this period, Chevron had 41 releases of oil ranging in size from a teaspoon to 42 gallons. In summary, operation of the Long Wharf would contribute to the significant cumulative levels of certain contaminants in the San Francisco Bay estuary. However, this contribution is extremely small compared to other sources, particularly runoff and municipal discharges.

Finally, the discharge of segregated ballast water from vessels visiting the Long Wharf would contribute to the significant cumulative adverse impacts to water quality and biological resources from the introduction of toxic microorganisms and invasive macroorganisms to San Francisco Bay. Because many of these organisms are so invasive even a small volume of discharge can have devastating effects that are not proportional to relative discharge volumes. The biological impacts of invasive species are discussed in detail in Section 4.3, Biological Resources.

Because Central San Francisco Bay and San Pablo Bay have been designated as impaired waterbodies for exotic organisms as well as for several chemicals (see Table 4.2-2), any contribution of contaminants of concern or exotic organisms from operations at the Long Wharf would be a significant advérse cumulative impact that cannot be mitigated to less than significant (Class I).

Contaminant levels on the outer coast generally do not exceed water quality objectives. Chevron tankering would not have a significant impact on water quality on the outer coast, except in the event of a major oil spill.

Section 4.1, Operational Safety/Risk of Accidents, presents a discussion of cumulative oil spill risk. A major oil spill would have a significant (Class I), cumulative effect on water quality.

<u>Mitigation Measure for CUM-WQ-1</u>:

CUM-WQ-1. Chevron shall implement the mitigation measures described for the proposed Project MM WQ-7 through MM WQ-9 and MM WQ-11 and MM WQ-12 to reduce project specific impacts to water quality.

<u>Rationale for Mitigation</u>: Chevron's implementation of measures to decrease spill risk and increase response capability, combined with preparation of measures specific to the Long Wharf in its SWPPP would help the Long Wharf reduce its contribution of contaminants into the water. In the long-term, documentation of vessels using TBT or other metal-based anti-fouling paints would help to reduce water quality impacts. Although Chevron may reduce its contribution of pollutants to San Francisco Bay, the

cumulative impact of degraded water quality, especially from urban runoff, is expected to remain significant. The development of Total Maximum Daily Loads for priority pollutants by the RWQCB and the implementation of Bay-wide measures to meet those loads will help to reduce cumulative significant water quality impacts.

Residual Impact: Impacts to water quality may remain significant.

Impact CUM-WQ-2: Introduction of Non-indigenous Organisms by Discharge of Segregated or Treated Unsegregated Ballast Water

Contribution of contaminants or exotic organisms from operations at the Long Wharf would be a significant adverse cumulative impact that cannot be mitigated to less than significant (Class I).

The discharge of segregated ballast water from vessels visiting the Long Wharf or unsegregated ballast water treated at Chevron's wastewater facility would contribute to the significant cumulative adverse impacts to water quality and biological resources from the introduction of toxic microorganisms and invasive macroorganisms to San Francisco Bay. No information is available on the volume of segregated ballast water discharged annually to San Francisco Bay by vessels associated with the Long Wharf. Table 4.2-14 shows the amounts of ballast water discharged by tank vessels operating in San Francisco Bay per year.

Table 4.2-14
Amounts of Ballast Water Discharged by Tank Vessels Operating in San Francisco Bay Per Year

Year	Amount Reported (metric tons)
2000	577,627
2001	958,846
2002	905,173
2003	518,058
2004	1,521,812
2005*	2,114,790

*** amounts through 12/15/05 Note: Between 2000 and 2003 the law exempted TAPS trade tankers (US Flagged, US Crewed tank vessels, carrying petroleum from one US port to another US port) and only required reporting on ballast water discharges at first port of call.**

Source: M. Falkner, California State Lands Commission, personal communication 2005.

Because many of the non-indigenous organisms in ballast water are so invasive, even a small volume of discharge can have devastating effects that are disproportional to relative discharge volumes. Moreover, non-indigenous organisms may remain in ballast water that has been exchanged in the mid-ocean. Unsegregated ballast water treated at the Chevron facility and discharged may still contain organisms. The biological impacts of invasive species are discussed in detail in Section 4.3, Biological Resources.

Mitigation Measures for CUM-WQ-2:

CUM-WQ-2. Implement proposed Project MM WQ-2 and MM WQ-5.

Rationale for mitigation: Adherence to this measure addresses procedures for ballast water management Chevron must follow for tracking the compliance of the vessels visiting the Long Wharf. The measure is a tracking measure only, and does not reduce the level of impact, as the problem is a regional/Bay-wide problem. Chevron shall not treat and discharge any unsegregated ballast water at its wastewater treatment facility because treatment methods may not remove all marine organisms.

Residual Impacts: Until a feasible system is developed kill organisms in ballast water, the discharge of ballast water to the Bay will remain significant (Class I).

Impact CUM-WQ-3: Oil Spills along Outer Coast

A major oil spill along the outer coast would have a significant adverse (Class I) cumulative impact on water quality. A spill along the outer coast would not be within Chevron's responsibility.

Contaminant levels on the outer coast generally do not exceed water quality objectives. Chevron's Long Wharf tankering would not have a significant adverse impact on water quality on the outer coast, except in the event of a major oil spill. Section 4.3.1, Environmental Setting, above presents a discussion of cumulative oil spill risk. A major oil spill would have a significant adverse (Class I), cumulative effect on water quality.

Mitigation Measures for CUM-WQ-3:

CUM-WQ-3. Implement MM OS-7a and MM OS-7b.

Rationale for mitigation: Measure OS-7a calls for Chevron to participate in VTS upgrade evaluations as opportunities arise. Such participation may help to evaluate and guide improvements in the VTS system. Measure OS-7b requires Chevron to respond to a spill from a tanker as if it were its own until the vessel's response organization can take over management of the oil spill response. This measure will insure that a spill will be responded to as rapidly as possible.

Residual Impacts: Impacts of large spills would remain significant (Class I).

Table 4.2-15 summarizes Water Quality impacts and mitigation measures.

Table 4.2-15
Summary of Water Quality Impacts and Mitigation Measures

Impact	Mitigation Measures
WQ-1: Sediment Disturbance to Water Quality from Vessel Maneuvers	**WQ-1:** No mitigation required.
WQ-2: Segregated Ballast Water	**WQ-2:** Adhere to California Marine Invasive Species Control Act; advise and ensure that vessel operators know of Act and fill out required questionnaire.
WQ-3: Cargo Tank Washwater, Bilge Water, and Sanitary Wastewater	**WQ-3:** No mitigation required.
WQ-4: Discharges of Firefighting Water	**WQ-4:** No mitigation required.
WQ-5: Non-Segregated Ballast Water	**WQ-5:** No discharge to San Francisco Bay; transport via tanker truck/other waste handling vehicle to appropriate facility.
WQ-6: Cathodic Protection	**WQ-6:** No mitigation required.
WQ-7: Anti-Fouling Paints	**WQ-7:** Vessel operators to document no new applications of TBT after Jan. 1, 2003. In 2008, Chevron to deny moorage to vessels without proof of IMO mandate.
WQ-8: Tanker Maintenance	**WQ-8:** Apply WQ-9 for preparation of SWPPP.
WQ-9: Stormwater Runoff from Long Wharf	**WQ-9:** Implement additional BMPs to reduce chemical inputs to Bay.
WQ-10: Maintenance Dredging	**WQ-10:** No mitigation required.
WQ-11: Oil and Product Leaks and Spills	**WQ-11:** Implement MM OS-3a through OS-3d and MM OS-4.
WQ-12: Water Quality from Accidental Spills	**WQ-12:** Implement MM OS-7a and MM OS-7b.
WQ-13: No Project Alternative	**WQ-13:** No mitigation is required.
WQ-14: Full Throughput via Pipeline Alternative	**WQ-14:** Implement MM GEO-8.
WQ-15: Conceptual Consolidation Terminal Alternative	**WQ-15:** Implement MM OS-3a-d, MM OS-4, and MM GEO-8.
CUM-WQ-1: Contaminants on Bay and Outer Coast	**CUM-WQ-1:** Implement MM WQ7 through MM WQ-9 and WQ11 and 12
CUM-WQ-2: Non-indigenous Organisms by Segregated and Unsegregated Ballast Water Discharge	**CUM-WQ-2:** Implement MM WQ-2 and WQ-5.
CUM-WQ-3: Oil Spills along Outer Coast	**CUM-WQ-3:** Implement MM OS-7a and MM OS-7b.